RECOGNITION AND CATEGORISATION
- A STUDY OF YOUNG CHILDREN

Roger Anthony Barrow

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ABSTRACT

This thesis is concerned with the extent to which young children co-ordinate diverse sources of information when recognising and categorising representational materials. Previous investigators have concluded that young children are not generally able to make such co-ordinations and traditionally, this poor performance has been attributed to young children's tendency to focus their attention upon specific, salient features of the stimuli.

Chapter One reviews the relevant literatures and considers several shortcomings of previous studies. Four main areas of interest emerge; these areas were the subject of inquiry of seven studies (reported in Chapters Two-to-Five) and are as follows:-

(i) Young children's spontaneous judgements of correspondence between objects and pictures (Chapters Two and Five).

(ii) Young children's spontaneous and second-choice classifications (Chapter Three).

(iii) Young children's ability to select representations of model stimuli (including, where necessary, quite arbitrary representations) in such a way as to permit specific and external informational constraints to be satisfied (Chapter Four).

(iv) Young children's ability to detect ambiguities (Chapter Five).

The studies reported yield strong evidence that young children systematically co-ordinate diverse sources of information in ways which often, are comparable to adults' co-ordinations. In particular, young children simultaneously co-ordinate multiple dimensions of correspondence in ways which vary systematically as a function of the circumstances of the identification or grouping; these circumstances include the degree to which correspondences permit stimuli to be unambiguously labelled, the manner by which stimuli are presented (eg., whether physically and/or verbally) and the composition of the stimulus sets. In addition, evidence was gained that a majority of children will re-classify stimuli by a second grouping criterion when they are given a sound reason for doing so and that a considerable proportion of young children detect certain ambiguities.

The main results are reviewed and discussed in Chapter Six. It is suggested that the present findings have considerable implications for the methods which should be used to tap and develop the co-ordinations made by children in relation to representational materials.

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Finally, the financial support for the work - which I gratefully acknowledge - was provided by a postgraduate studentship from the Social Science Research Council.

I declare that this thesis is my own unaided work.

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Roger Anthony Barrow

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CHAPTER ONE: YOUNG CHILDREN'S IDENTIFICATION OF EVERYDAY OBJECTS AND PICTURES OF SUCH OBJECTS

1.1 Preliminary remarks; setting the scene

This thesis is concerned with how preschool children co-ordinate visual and/or verbal cues when identifying representational materials - especially pictures. It is evident that Western children are exposed to a 'barrage' of pictorial representations of objects of varying degrees of familiarity; this barrage comprises for example, family photographs, pictures in comics, picture books, magazines and newspapers, pictures on television, retail packages, cards, stamps and even on china, bedspreads, T-shirts and place-mats and the like; besides which many games children are encouraged to play (for example, picture dominoes and jigsaw puzzles) are picture-based. These various pictorial media vary considerably in the accuracy with which they portray their referents; this accuracy would seem to depend partly at least upon the function to which the picture is to be put; that is, whether it is intended as an accurate record (as for example in the case of family photographs) or simply as an amusing illustration (as for example in the case of caricatures). Informal observation tends to suggest that young children are quite competent at identifying pictures accurately. There is however, as will be seen, a considerable body of opinion which whilst recognising that children may succeed in making many identifications correctly nevertheless emphasises that young children are extremely limited in their ability to co-ordinate the diverse sources of information which may be present in representational stimuli. The primary experimental focus of the present investigations has been with how young children judge correspondence between pictures and objects in circumstances in which a fairly high degree of representational accuracy is implicitly assumed. Arguments will be advanced and evidence presented which suggests that the case for young children's poor co-ordinative skill is not as unequivocal as might first appear. In particular, because it seems reasonable to suppose that children will expect there to be some positive correspondence between pictures of objects and the objects portrayed, the particular correspondences which children demand to be present in pictures of model objects would seem to be likely to reveal something about the features of the objects which are dominant in children's concepts of those objects.

Several preliminary points should be made in this section as to the kind of correspondence judgements which may be made and as to which of these were investigated in the present studies. The first point is that thc kinds of correspondence which can be compared depends upon the amount of information which is given about the model object. If a specific object model is physically presented then the correspondence may be judged very precisely. If however a model object is not physically presented but is instead verbally described then correspondence may be judged, depending on the information given, at a number of different levels of abstraction. The present correspondence studies have been mainly concerned with these two kinds of object presentation - that is physical presentation and verbal description. (In the case of the verbal presentations the objects were described at very specific levels of abstraction.) Some consideration has also been given however to preschool children's judgements concerning the adequacy of pictures when no specific object models are given - either physically or verbally.

The basic method adopted in the present correspondence studies was to show children several model objects and to then show them one picture - or alternatively a few pictures - of each object. Typically, the picture or pictures failed to correspond to the pertinent object in some substantial way. The children were then asked either to judge whether individual pictures corresponded adequately to their respective object models or to judge the relative adequacy of different pictures of the same object models. This method was preferred to that of gctting children to draw their own pictures because the act of drawing itself tends to produce considerable inter-subject variance. Thus Freeman (1977), for example, observes that young children may have considerable planning problems when drawing their own pictures, that they are also influenced by external frames or reference such as the paper edge and that when they draw from memory they may have considerable retrieval problems. Ey presenting children with pre-drawn pictures such confounding influences were avoided.

There are of course many kinds of possible discordance between an object and a picture of that object. Some or all of the parts present can be changed in various ways (omission of parts, addition of parts, substitution of parts and alteration of the proportion of parts); the arrangement of some or all of the parts present can be changed in either ecologically valid or invalid ways (cf., Kennedy, 1974); and finally, colouring, portrayed texture and perspective can all be manipulated. The present studies have however been concerned with young children's object-picture correspondence judgements with regard just to two kinds of discordance: changes of parts present (ie., shape) and changes of colour.

Although the investigation of preschool children's object-picture correspondence judgements was the major issue addressed by the present studies, a number of other areas of interest were also examined. In the first place (and as indicated above), the results of the correspondence studies are considered to have a number of implications for the nature of children's (and adults') concepts of everyday objects and these implications were followed up using more traditional conceptual tasks. A second area of additional interest has been that of the extent to which young children are able to use more symbolic (or arbitrary) means of representing objects than that involved in straightforward pictures of objects. It is widely recognised that young children do possess some ability to treat objects as though they are something other than what they are (see, for example, Piaget, 1951; what is not so clear however is the extent to which young children are able to select relatively arbitrary representations in such a way as to permit specific and external informational constraints to be satisfied. Young children's ability to use more arbitrary forms of external representation in a manner calculated to satisfy some external informational requirement was the subject of a specific investigation by one of the present series of studies. This skill is quite demanding cognitively and the degree to which preschool children succeed on such a task would seem likely to provide important information concerning the development of the ability to think systematically in symbolic terms.

The third and final topic with which the present investigations have been concerned is that of young children's ability to detect ambiguities in representational materials. Previous reports have suggested that young children are unable to detect such ambiguities and these findings have added credence to the traditional view that young children are severely limited in their ability to co-ordinate diverse sources of information on identification tasks.

Altogether then the present enquiry focuses upon four subject areas. The primary issue concerns how preschool children judge correspondence between objects and pictures. Additionally however the present studies investigate the nature of children's concepts of objects and the ability of young children to think systematically in symbolic terms and to detect ambiguities. There is a considerable body of opinion which holds that preschool children will be generally unable to respond in a systematic and co-ordinated fashion on the kinds of task envisaged. The critical issues are reviewed in the three remaining sections of the present chapter. The next section (Section 1.2) considers critically the evidence for the view that preschool children are severely limited in their ability to co-ordinate information when identifying representational materials. The identification of such materials necessarily presupposes that the relevant objects have been conceptualised and the following section (that is, Section 1.3) discusses the kind of concepts which young children seem likely to possess. The final section (Section 1.4) presents a brief overview of the experimental work undertaken.

1.2 A consideration of young children's picture identification skills

Genuine picture perception would seem to require that an observer grasp that pictures evoke what Deregowski (1980) calls an 'ambiguous percept', that is, the observer must appreciate that whilst the picture is itself merely an artificially treated surface, it nevertheless represents an absent object or objects. Failure to discern either of these defining characteristics of pictures cannot then lead to genuine picture perception. At least two sorts of error may occur. In the first case, the picture may merely be directly perceived as a display without there being any appreciation of its representational significance (cf., Gibson, 1954, cited by Kennedy, 1974). Alternatively, in the second case, the observer may recognise the object or objects portrayed by the picture but may fail to understand that the picture is merely a display, in other words, the picture may be mistaken for the object or objects it is in fact only representing. In this second case - as with the first - genuine picture perception does not occur because of a failure to appreciate the representational significance of the picture.

It seems fairly clear that from about two years onwards at least, children begin to recognise objects portrayed in pictures. Indeed the facility with which most young children name pictures of familiar objects (their so-called 'picture-vocabularies') has been exploited on intelligence test items since the days of Binet. According to the Stanford-Binet norms the correct naming of eighteen outline drawings of common objects increases from an average of three at two years to an average of fourteen at four years. An important study by Hochberg and Brooks (1962) confirmed that the ability to recognise outline drawings and also photographs is acquired by two years and demonstrated moreover that the development of this ability requires no specific training. This latter finding has done much to invalidate the view that the recognition of pictures requires some sort of instruction in a convention of representation. It should be noted that young children do evidence some deficits in their ability to grasp the spatial relations of two-dimensional patterns (for example, they do not make accurate judgements of the represented sizes of pictured objects in certain experimental situations), however on the whole their pictorial spatial skills are reasonably well developed (cf., Olson, Yonas and Cooper, 1980). Certainly the recognition of representational pictures of isolated, everyday objects should not present any difficulty; indeed, such simple identification tasks are now widely acknowledged to be,

> "a very simple task for nearly all people independently of culture or education (Jones and Hagen, 1980 p. 219)."

The ease of such tasks appears moreover to be unaffected by the mode of representation (eg., whether colour or black and white photographs, outline or coloured drawings, etc.) Even animals who have been conditioned by operant procedures to discriminate between objects, transfer readily to discriminate between drawings of these objects (Herrnstein and Loveland, 1964; see also Hayes and Hayes, 1953; Herrnstein, Loveland and Cable, 1976; Köhler, 1925.)

It seems likely then that young children readily recognise familiar objects portrayed in simple pictures. Whether or not they also understand that pictures are <u>simply</u> displays is however more problematic. In particular, both Piaget (1951) and Werner (1948) have suggested - each on the basis of rather limited anecdotal evidence - that young children sometimes mistake pictures of objects for the objects themselves. The present writer is aware however of only one empirical study which bears directly on this issue and its results moreover do, if anything, tend to suggest that young children do appreciate that pictures are in themselves simply two-dimensional displays. Specifically, Wheeler (1972) conducted two experiments in which preschool children (with a mean age of four years) were shown a series of matching object and picture pairs (for example, a toy train and a picture of a train). The first experiment found that, given instructions such as, 'show me the train' the majority of subjects pointed to the picture at least once. As Wheeler herself notes however, adults will often refer to or describe a picture by giving the name of the object it represents and consequently the results are not decisive; significantly moreover, hardly any subjects pointed to the object when asked specifically to point to the picture (for example, when given the instruction, 'show me the picture of the train'). In the second experiment, Wheeler asked a comparable group of children to perform actions which, she assumed, could be legitimately carried out with the object but not with the picture. For example, having presented subjects with the train object-picture pair, Wheeler instructed her subjects to 'push the train to me'. Wheeler found that the great majority of her subjects chose to perform the actions upon the objects rather than the pictures. Wheeler herself does not however take these results to disconfirm the view that young children fail to appreciate that pictures are two-dimensional. In particular, she stresses that the justifications offered by the subjects for their choices were not generally wholly satisfactory. There is however a danger in making too much of such justifications (after all, the kind of evidence which they yield is little different to that upon which Piaget (op.cit.) and Werner (op.cit.) based their original suggestions). To define what pictures are precisely is not an easy task and preschool children have only a small vocabulary. Certainly, the mere fact that young children tend to draw attention to the representational aspect of pictures should not be taken to indicate that they are necessarily unaware of their two-dimensional properties.

As was implied in the previous section (1.1) young children have, for a long time been reported to perform poorly on a considerable range of tasks of perceptual identification and differentiation (see, for example, Vurpillot, 1976a). These alleged limitations have not shown up on simple object or picture identification tasks (as may be deduced from the preceding discussion); rather they have surfaced on tasks where children have been required to identify impoverished or ambiguous stimuli or to judge equivalence between stimuli. Young children have, for example, been found to be less competent than either older children or adults on tasks requiring the accurate identification of incomplete pictures (cf., Gollin, 1960; 1961; 1962; 1965; 1966; Rey 1947; Vurpillot, 1962), the detection of anomalies in representational material (Segers, 1926a; Vurpillot, 1962), the spotting of ambiguities in ambiguous figures (eg., Elkind, 1964; Elkind and Scott, 1962)[1], and the integration of parts and wholes in pictures having a number of elements, each element constituting a picture in its own right and the configuration of elements comprising another object (cf., Elkind, Koegler and Go, 1964; Meili-Dworetski, 1956, originally published 1939; Whiteside, Elkind and Golbeck, 1976). In addition it is widely reported that when young children are given two or more visual stimuli to compare, they are unable to make satisfactory judgements either of logical classes of equivalence or of logical identity (cf., Beagles-Roos and Greenfield, 1979; Vurpillot, 1968; see also, Forman, Kuschner and Dempsey, 1975).

It is often concluded that young children perform poorly in these studies because, lacking the ability to co-ordinate perceptual information from a variety of sources they tend instead to focus their attention on specific salient features of the stimuli. So, for example, the young child's poor ability to reliably identify incomplete pictures has been attributed to a relative inability to co-ordinate the elements systematically (Kennedy, 1974). Similarly, the young child's poor detection of anomalies and ambiguities has

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(1) Following Fisher (1968), the term 'ambiguous figure' is used in this thesis to refer solely to figures where it is the subject seemingly represented which is reversible and should not be taken to refer to figures such as the Necker cube which are ambiguous in the alternative sense that they may be interpreted as the same form from either one of two different vantage points (Fisher calls these latter figures 'reversible figures').

been attributed to a tendency to focus on one part of the stimulus or one perceptual organisation of the figure respectively (see, for reviews, Elkind, 1969; Elkind, 1975; Vurpillot, 1976b). Comparable conclusions have been reached with regard to young children's acceptance of non-identical pictures as identical and the lack of any apparent basis to their judgements of equivalence (see, for example, Vurpillot, 1976a).

In concluding her review article, Vurpillot sums up the nature of young children's difficulty with such identification tasks as follows:

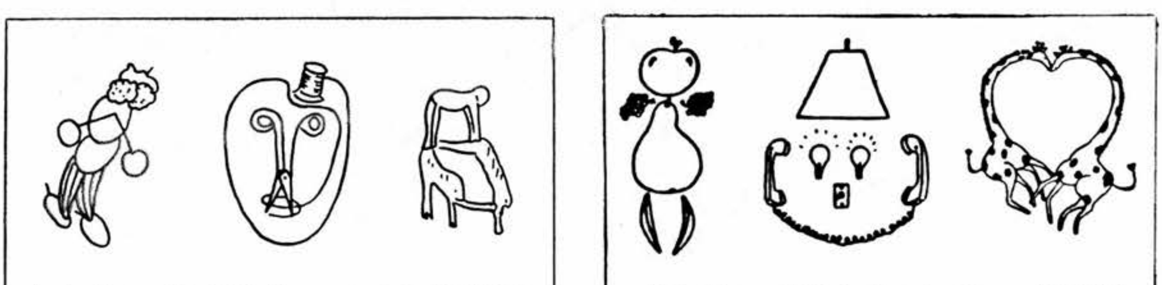
> "The young child takes into consideration only a part of the available information at a given moment. He makes a comparison of the objects on only one of their dimensions, preferably the most perceptually salient. He identifies them according to a critical characteristic. His scanning is limited to a small number of details or elements. His responses fluctuate and are often contradictory from one moment to the other because he focuses his attention first on one detail, then on another or refers first to one dimension and then to another, or uses one cue and then another to localize or identify. Thus, his greatest weakness lies in an <u>absence of co-ordination</u> between all the cues he is capable of perceiving and the rules he is capable of using (1976b, p.231, emphasis not in original)."

The implication of this kind of argument is that children succeed in identifying simple pictures (and objects) not because they adopt a more advanced strategy but simply because the strategy which is ineffective for the more complicated pictures is typically though not always sufficient for success with the straightforward pictures. That is, because the latter pictures do not contain anomalies or ambiguities the child who focuses his attention on one part of the picture will be quite likely to make a correct identification. The suggestion that young children perceive objects and pictures in this way is by no means novel. The old debate (at the beginning of the century) between <u>elementarism</u> and <u>syncretism</u>, recognising as it did that young children's strategies for identifying pictures and objects are in some way immature, turned precisely on the issue as to whether the young child bases his identifications upon one or a few of the parts (elementarism or, as it is otherwise called, the analytic view) or upon a confused view of the whole (the syncretist view). Indeed, some of the studies cited above were conducted specifically to distinguish between these views; Segers for example

(1926a) himself a supporter of the syncretist position, presented groups of children of various ages with a series of monster stimuli, each stimulus comprising a head and a body from different kinds of animals. Apparently assuming identifications of the stimuli based on the body parts to be equivalent to a focus of attention on the 'allure générale' (that is, the 'general look') of the stimulus and therefore equivalent also to the syncretist position, Segers concluded from his results that children only begin to take details into account from about seven years onwards.[2]

In recent years Vurpillot (1976a) has convincingly argued that the distinction between analytic and syncretic perception is of virtually no explanatory value. Freeman (1980) concurs with this conclusion. Vurpillot (op.cit.) makes a particularly strong case in relation to the studies using composite figures of the kind illustrated in Figure 1. Specifically, Meili-Dworetski (1956) found that young children first perceive the wholes rather than the parts whereas Elkind (eg., Elkind, Koegler and Go, 1964) found that children first perceive the parts and progress only later to perceiving the wholes before finally, later still, being able to integrate both parts and wholes. Examples of the figures used by these investigators are illustrated in Figure 1:a and Figure 1:b respectively. Vurpillot points out that the figures used by Meili-Dworetski and by Elkind and his associates respectively are qualitatively very different; specifically, in Meili-Dworetski's figures the wholes are highly articulated relative to the parts whereas in Elkind's figures the parts are highly articulated relative

<u>Figure 1</u> Some of the composite figures presented by Meili-Dworetski (1956) and Elkind et al., (1964), respectively.



(a) From Meili-Dworetski (1956) (b) From Elkind et al., (1964)

[2] This study is further discussed below and also in Section 5.2.1a.

to the wholes. As Vurpillot concludes, it seems likely that young children will actually attend to either the parts or the wholes depending upon the properties of the stimuli presented.[(3)] Vurpillot denies however that such children can attend to both parts and wholes simultaneously; this ability does not, she suggests, generally develop until eight years or so. Consequently, she continues to view the manner of young children's identification of pictures and objects in terms of a failure to attend to all the aspects - a position which is in line with the spirit if not the precise format of classical traditions. This assessment of young children's identification skills which, as has been noted, is fairly widespread has often been explicitly associated with Piaget's theories of perceptual and cognitive development and it is Piaget's theories which will next be considered.

In his theory of perceptual development, Piaget (eg.,1969) argued that young children's perceptions are centred on one or another dominant feature in the perceptual field (these are referred to as 'field effects'); which features are dominant being said to be determined by the Gestalt properties (continuity, closure and proximity) of the stimulus. Piaget's notion of centring does, when applied in this perceptual context, appear to be virtually interchangeable with the idea discussed above that children tend to focus on salient aspects of a picture or object when identifying it. However an element of caution is required when so doing; specifically, Piaget himself only applied his theory of perceptual development to quantitative perceptual judgements made with respect to visual illusions. Consequently, the application of his theory by Elkind and others to children's identification of representational materials - which are qualitative judgements requiring the use of conceptual as well as perceptual processes (Elkind, 1969; the same point is also made by, for example, Bruner 1957; Neisser 1967; Piaget 1969; Potter 1966) - constitutes an extension of his theory which Piaget himself might not have sanctioned.[(4)] Elkind (eg., 1969) recognises his

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(3) N.B. Vurpillot acknowledges that this conclusion is anticipated by Meili (1931).

(4) In this regard, Wohlwill (1968), has suggested that whilst Piaget's perceptual theory is appropriate for quantitative perceptual judgements, it is not appropriate for 'qualitative judgements and more particularly with judgements of identity or difference among discrete categories of stimuli (where) we typically find something closely approaching the reliability and specificity of conceptual classifications (p.482; originally published 1962)'. Indeed, Piaget himself (1968a) drew a clear distinction between the acquisition of qualitative and quantitative invariance.

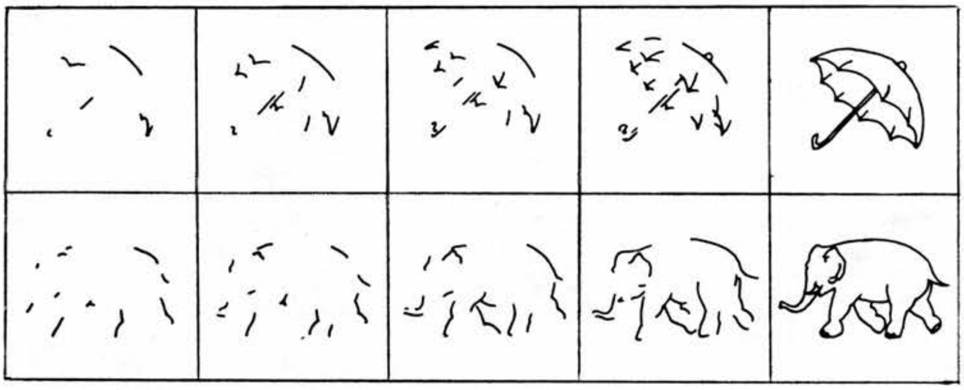
extension of Piaget's theory explicitly. He does not however, stop here. Specifically, he (eg., Elkind, Koegler and Go, 1964) and Vurpillot (1976a) have each further suggested that the young child's inability to integrate the parts and the wholes of composite figures (for example, to recognise that the same group of lines can be seen both as a banana and as the body of a cyclist) is analogous to his inability to recognise that, in the logic of classes, an object can belong to several inclusive classes simultaneously. Whether or not they are analogous is not actually of great significance since analogies are in no way explanatory nor are their subjects necessarily related. Such a consideration does however raise the important issue of the relation in Piaget's theory between the development of perceptual flexibility and that of mental (or operational) reversibility. Piaget, in his theory of perceptual development, argues that conception - which he equates primarily with inference and intelligence and not with the kind of conceptualisation required for the recognition of representational materials - develops independently of perception but that intellectual developments lead, eventually, to the enrichment of perception such that perceptual activities (a technical term) become guided by intelligence and also become semi-reversible (centration-induced perceptual distortions are therefore only partially compensated). Perception then never attains the power and flexibility of conception which, with the development of operations (particularly that of reversibility) at about seven years, becomes fully reversible. As Flavell observes (1963), the zenith of perceptual structures is roughly equivalent to the structure of late preoperational thought. A clear distinction should therefore be made between the limited perceptual flexibility which Piaget notes to be shown by maturer subjects when they view visual illusions (and which Elkind and others apply to explain the perception of ambiguities in composite and ambiguous figures) and the mental operation of reversibility which is required in order to solve logical problems such as class inclusion.

For the purposes of this thesis the process of centring will be defined very generally as, 'a tendency to focus attention on single sources of information rather than co-ordinate information from a variety of sources.' Such a broad definition encompasses both the kind of centring that may occur on purely perceptual problems as well as that kind of centring which occurs when children recourse to centring on a transient perception as a method of solving a logical problem; it can also handle the possibility of the sources of information being linguistic. This definition whilst it does not perhaps (as has been noted) accord strictly with the limited senses in which Piaget originally used the term does nevertheless appear to accurately reflect the senses in which the term has been used by other investigators. Of particular relevance to the present study is that young children's predispositions to centre on single sources of information has been widely used as a theoretical basis for interpreting children's performance on a variety of tasks involving the presentation of representational materials. In recent years however the whole Piagetian view of early development has been increasingly challenged by the emergence of a considerable literature which has suggested that, in a number of areas, Piaget consistently underestimated children's ability to <u>integrate information</u>. Wilkening, Becker and Trabasso (1980), in reviewing these areas include perceptual judgement, moral and social judgement, decision making, problem solving, discrimination learning, story comprehension and discourse processing in their list. In addition Donaldson (1978) in reporting some of the recently obtained evidence indicating that young children possess some ability to make judgements of quantitative invariance, has suggested that young children sometimes centre on such tasks for reasons other than a lack of the logical operations required. Such a suggestion raises the possibility - not previously given much attention - that centring may, in some circumstances, be a <u>reasonable</u> thing for a child to do. This latter suggestion does not accord with the rather doctrinaire assumption made in relation to the process of centring in the past to the effect that it is an immature, unco-ordinated and pre-logical response.

One overriding concern in the present study then was to investigate whether young children are indeed as limited in their ability to co-ordinate information with regard to representational materials as has tended to have been assumed in the past and in particular to investigate the possibility that centring on some tasks which use representational materials may not be, from the child's point of view, an unreasonable thing to do. Of considerable relevance for this issue is whether the poor performance recorded by young children on the identification and equivalence judgement tasks reviewed above can be explained without recourse to the conclusion that young children lack the co-ordinative skill necessary for success on such tasks.

Consider first the case of incomplete figures (see Figure 2 for some examples of the kinds of figures which have been used). One reason why young children perform poorly may be that their knowledge

Figure 2 Some of the incomplete figures presented by Gollin (1960).[1]



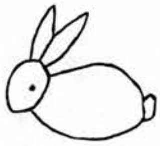
[1] The series of figures illustrated are the only ones reproduced by Gollin in this paper (cf., Gollin 1961 for further figures). Other identities used by Gollin (1960) included a bell, a chair, a table viewed from below, a table viewed from above, a telephone etc.

of the visual appearance of the objects represented (and also their knowledge of those objects which they think might be represented) is insufficient to allow them to make correct identifications when the drawings are relatively incomplete. Additionally, several at least of the drawings which have been presented (see Vurpillot, 1962) have been of a schematic type with which young children may not be generally familiar. Young children's lack of knowledge relative to older children and adults may not be the sole explanation of their performance on these tasks; however it does seem possible that a failure to take note of knowledge factors has led to the under-estimation of the identification co-ordination skills possessed by young children.[5]

[5] Nevertheless it should be pointed out that Gollin (1960) did find that the performance of children as young as 54 months to 65 months (no mean age is given) did not differ significantly from that of an adult control group.

The same reasons may be applied as a counter explanation (or partial explanation) of young children's inability to detect the anomalies and ambiguities contained in anomalous stimuli and composite and ambiguous figures respectively. Examples of the anomalous stimuli presented by Segers (1926a) and Vurpillot (1962) are not readily available; Vurpillot (op.cit.) does however reproduce two non-anomalous stimuli, the elements of which she combined in every possible way to produce the anomalous stimuli used in the study. As can be seen from the drawings illustrated in Figure 3, the stimuli Vurpillot used are highly schematised and not necessarily blatantly monstrous at all. Most importantly however, neither Vurpillot nor Segers took any account of whether their subjects knew the identity of the parts combined; certainly, it would not be unreasonable for a child who knew the identity of only some of the parts to base his identification of the whole upon the identity of those parts whose identity was known.

Figure 3 Reconstruction (from Vurpillot, 1976 b) of some of the anomalous stimuli presented by Vurpillot (1962).

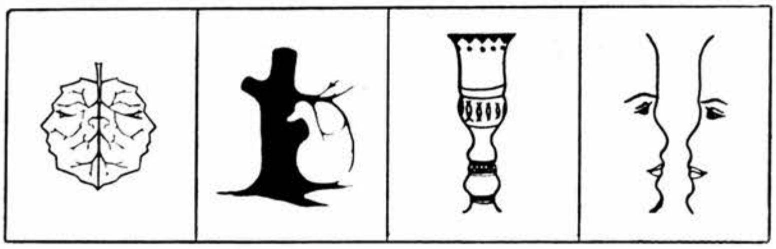


(a) 'rabbit' (sheep's wool anomalous)

(b) 'sheep' (rabbit's tail anomalous)

Examples of some of the composite figures that have been presented to young children have already been illustrated in Figure 1 and, as has already been observed, such figures do not tend to possess well articulated parts and wholes, instead, one of these perceptual organisations is typically rather indistinct. The same may be said - as a consideration of Figure 4 will verify - for the ambiguous figures used by Elkind and his colleagues (Elkind 1964; Elkind and Scott 1962).

Figure 4 Some of the ambiguous figures presented by Elkind (1964).



Besides having drawbacks arising from the materials used, most of the studies of children's detection of anomalies and ambiguities cited have additional limitations. To begin with, the studies carried out by Segers (op.cit.) and Vurpillot (op.cit.) each failed to take any account methodologically of the possibility that whether or not young children detect anomalies may to some degree be dependent upon whether parts from similar or dissimilar kinds of animals are combined (consider, for example, cow and horse versus cow and duck). For Segers' study, the relevance of this argument is that 'centring' may have been a dominant strategy simply because his subjects were not given anomalous stimuli which would have been regarded as sufficiently monstrous to warrant objection. The significance of this argument for Vurpillot's study is however negated by 'virtue' of an even more serious weakness. Specifically, curious as it may seem, the nature of Vurpillot's experimental design prevented her subjects from identifying any of the stimuli as monsters. (A full account of the rationale of Vurpillot's study is given in Section. 5.2.1.a .) Elkind's studies of children's ability to detect ambiguities in ambiguous figures and composite figures also have an additional limitation. Specifically, Elkind failed to give any information to his subjects indicating the special nature of the pictures to be presented. Subjects were simply given an instruction such as:-

> "I am going to show you some pictures, one at a time, and I want you to tell me what you see, what it looks like to you (Elkind, 1964 p. 1393)."

It seems unlikely that such a neutral instruction would have motivated young children to attend the figures for any length of time. So far, the limitations of the studies which have been discussed have been methodological. There is however one aspect of the <u>results</u> of the studies cited which should be commented upon. Specifically, whilst the performance of the older (control) subjects is generally superior to that of preschool children, the level of success achieved is considerably below that which is possible (see, especially, Elkind and Scott 1962; Segers, 1926a). This point warrants mention because it indicates that the relative inferiority of preschool children's performance is not so great as might be supposed.

The fifth and final area cited above in which studies using figurative materials have been interpreted in terms of young children's predispositions to centre in an unco-ordinated fashion upon salient aspects of the stimuli presented is that of judgements of logical identity and logical classes of equivalence. Most of the studies of interest here have been conducted by Vurpillot and her associates. According to Vurpillot (1976b), two perceptual stimuli are logically identical if they are exactly the same. Logical classes of equivalence on the other hand are said to require merely that a group of stimuli should be subordinated to a single set of attributes (Vurpillot, 1976a). Vurpillot's use of the term 'logical classes of equivalence' therefore accords strictly with classical definitions of conceptual groupings (see, for example, Bruner and Olver, 1963; Inhelder and Piaget, 1964; Vygotsky, 1962, originally published, 1934; Werner, 1948).

Vurpillot's primary interest has been in the development of the ability to correctly judge logical identity; her concern with the emergence of logical classes of equivalence having been more incidental. The technique generally used for investigating the possession of identity relationships has been to present subjects with pairs of identical and non-identical stimuli and to require subjects to judge whether the stimuli are, 'the same' or 'not the same'; the presentation of non-identical as well as identical pairs being necessitated by the finding that whereas the great majority of young children accurately judge physically identical pairs of stimuli as the same from the age of about 3:6 years, a comparable majority do not systematically judge dissimilar pairs to be different until at least 6:6 years (Vurpillot, 1976a). These studies have typically used pairs of pictures (eg., Beagles-Roos and Greenfield, 1979; Olēron, 1962; Vurpillot, 1968; Vurpillot and Moal,1970) but occasionally, object-picture pairs have been used (eg., Babska 1965). The conclusion reached by Vurpillot (eg., 1976a) is that these studies indicate that logically defined identity relationships (that is, of logical identity and logical classes of equivalence) do not generally occur until six years of age. Before that, she says, the child's groupings are based only on partial equivalences which, because they involve <u>changing</u> criteria of equivalence are pre-logical. Vurpillot (1976a) actually outlines five stages in the acquisition of logical identity relationships. In the first of these stages, 'same' judgements, she says,

> "express a communality of representational meaning between two objects; there does not appear to be any extraction of a common part or attribute. Two pictures or two objects are judged the same because their perceived form represents the same thing. For example, all pictures identified as 'houses' are described as the same, whilst a picture identified as 'a house' and another one identified as 'a duck' are described as 'not the same' (p.309, emphasis not in original)."

Vurpillot then describes how, in the following stages, the child progresses to using adult criteria of 'same' and 'not the same' though initially only for part of the stimuli and only for some of those dimensions to which he is sensitive. (Vurpillot identifies real differences of form as being, apparently, the first kind of difference which is widely judged to be incompatible with a 'same' judgement.) Gradually however, the child's perceptual searches become more extensive and a reciprocal correspondence is then required between each part; finally, in the fifth stage, the spatial arrangement of the parts is required to be identical and only then is the development of the relation of logical identity complete.

Vurpillot's developmental analysis closely resembles that made by Piaget and Inhelder (1956) when they examined young children's ability to make copies of model necklaces and model washing lines. The question arises however as to whether Vurpillot is entirely justified in concluding that young children lack appreciation of logical identity and logical classes of equivalence. With regard first to the ability to judge logical identity, it is evident that, in the studies upon which Vurpillot's conclusion is based, subjects were required to grasp that when they were asked if two stimuli were the same or different, it was a judgement of logical identity which was being requested. It is possible however that young children will not typically appreciate that this is the kind of judgement required; specifically, Vurpillot's subjects may have supposed the request to be for a judgement of correspondence at a less absolute level than that which Vurpillot intended them to. If this is so, Vurpillot's results may merely map developmental changes in children's interpretation of what her task required rather than developmental changes in children's ability to judge logical identity.

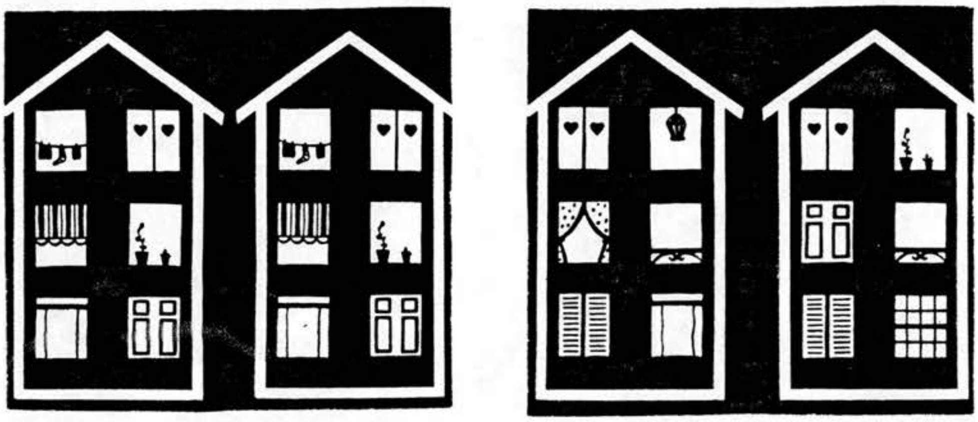
Consider the first stage which Vurpillot describes. Vurpillot assumes that children at this stage operate with classes of equivalence which are pre-logical. Her reason for this assumption is based, as has been stated, on the classical approach to concept formation; specifically, these children's equivalence judgements are held to be pre-logical because they do not appear to be governed by the presence or absence of any single attributes or sets of attributes. In recent years however, the validity of the classical approach to concept formation in relation to everyday objects has been severely questioned. In particular, it has been suggested that natural concepts are seldom composed of a set of defining features (eg., Anglin, 1974; Fodor, 1972; Labov, 1973; Mervis and Rosch, 1981; Miller and Johnson-Laird, 1976; Nelson, 1974; see also Cassirer, 1953, originally published, 1923; Cassirer, 1946 and Wittgenstein, 1958). One suggestion (eg., Bransford, 1970; Johnson-Laird and Wason, 1977) is that the essence of natural concepts may often be best characterised in terms of what may be called a <u>relational structure</u> (such a structure being perceptually and/or functionally defined). Take, for example, the concept of 'house'. Houses do not have the same value on any dimension of perceptual correspondence, be it colour, shape, size, texture or anything else. The essence of a house is rather that it is a secure and comfortable object to live in. Such an object will tend to have certain features (for example, a roof, walls and windows) which are distributed in fairly predictable ways (for example, the roof is positioned above the walls); these features however, will vary greatly in very many ways - for example, in their precise position relative to each other and in their appearance. These considerations suggest then that the young child who judges two houses to be the same on the basis that they are <u>both houses</u> (that is the kind of equivalence judgement occuring on Vurpillot's stage one) may not be making the pre-logical judgement which Vurpillot supposes. In the course of a discussion of her studies, Vurpillot (1976a) comments, in a passage which conveys some astonishment:

> "In these experiments, 5-year old children were quite able to see permutations involving two of the windows of a house or two parts of a configuration, comment on them, and at the same time conclude that, nonetheless, the house or the

configuration had not been changed (p.212)[6]

A sample of the kind of material used in these experiments is reproduced in Figure 5. It is evident however that if Vurpillot's purely classical approach to the bases upon which logical categorisations may be based is replaced by a more relation orientated model, such judgements do not then appear to be at all unreasonable.

Figure 5 Some of the house pairs used in Vurpillot's studies of the development of logical identity relationships (from Vurpillot, 1968).



(a) Identical house pair (b) Non-identical house pair

To summarise the main points so far. A considerable body of literature has been reviewed which, in the past, has been taken to support the view that when performing a variety of tasks involving figurative materials, young children consistently fail to co-ordinate information. There are however, alternative explanations of these poor performances which, if accepted, suggest that young children may not be so limited in their ability to co-ordinate information as has been previously supposed. One important point which emerged is that accurate identification of representational materials and logical judgements of equivalence between representational items necessarily require that the observer use his conceptual knowledge of the objects or

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(6) Two houses differ by a permutation when the contents of each window of one house is exactly the same as that of the corresponding window in the other house with the exception that, for a given number of windows, identical contents appear in different positions in the two houses. The non-identical pair of houses shown in Figure 5 differ not by permutation but by substitution, that is, the contents of a given number (in this case, two) of windows in one house do not correspond to those in any of the windows in the other house.

depicted objects. Very often however, investigators do not seem to have paid adequate attention to the assessment of the kind and extent of the relevant conceptual knowledge which their subjects possessed. The next section (1.3) addresses just this question; specifically, it considers the conceptual knowledge of concrete objects which young children seem likely to have.

1.3 On the nature of young children's concepts of everyday objects

Precise definitions of what concepts are vary. Most if not all such definitions recognise however, that concepts permit the categorisation of discriminable stimuli into the same category or class (eg., Anglin, 1977; Bruner, Goodnow and Austin, 1956; Donaldson, 1976; Smith and Medin, 1981). However although concepts underlie the processes of categorisation, concepts are probably best not equated with the resultant categories. This is because concepts are richer than categories. Concepts comprise all the knowledge possessed by a person about a category and its members but not all of this knowledge is necessarily used in categorisation. Different people are more likely to possess categories which are exactly the same than they are to possess concepts which are exactly the same. The classificatory systems which concepts provide are generally agreed to serve a number of functions the most important of which are, perhaps, that they permit the reduction of complexity in the world so as to make it more manageable and predictable and that they make possible inferences which can transcend mere perception. There is though considerable disagreement as to which of the possible bases of similarity are those actually used in the formation of categories. The primary concern of the present section is to consider the development of the classificatory systems operating in relation to concrete objects; however, insofar as such systems are based upon conceptual knowledge, the following discussion also constitutes a consideration of the development of concepts. The classificatory systems (and, by definition, the concepts underlying them) arising in relation to concrete objects operate at a number of levels of abstraction. The higher the level of abstraction, the more abstract is the category (or concept) supporting it. It might be supposed that 'categories' of concrete objects at the very lowest levels of abstraction are not abstractions at all; there is however a sense in which all such knowledge is abstracted knowledge (cf., Pikas, 1966, cited by Donaldson, 1976).

The classical view of concepts (so called because it dates back to Aristotle) is that all instances of a concept share common properties that are necessary and sufficient to define the concept. There is some dispute as to whether the classical view defines concepts purely in terms of appearance. Anglin (1977), Cassirer (1953) and Nelson (1974) for example, assume that this is the case; however, Smith and Medin (1981) argue that this is a misconception arising from the fact that traditional studies of concept formation have, for practical, but not as has been assumed for theoretical reasons, tended to investigate the attainment of concepts that have been defined exclusively in terms of appearance. The traditional studies have been of two kinds: classification tasks (eg., Bruner, Olver and Greenfield, 1966; Inhelder and Piaget, 1964; Reichard, Schneider and Rapaport, 1944; Vygotsky, 1962; Werner, 1948) and concept attainment tasks (eg., Bruner, Goodnow and Austin, 1956; Kendler, 1961). In both kinds of study subjects are presented with an array of stimuli which vary greatly in their values on a variety of perceptual dimensions; these stimuli are often artificial (for example, geometric forms of various colours and sizes). In classification tasks subjects are typically asked to put together those stimuli that 'are the same in some way'. Two requirements are traditionally made for a demonstration of proper classificatory skill: first, subjects should adhere rigidly to a chosen criterion of grouping and second, subjects should be able to abandon this criterion by a deliberate act of decision and reclassify the stimuli on a completely different basis (Campbell, Donaldson and Young, 1976). Concept attainment tasks are, on the other hand, rather akin to the modern game of mastermind. In these tasks, subjects are required to identify a concept chosen by the experimenter (for example, spheres of any size which are coloured with red and green stripes) by using feedback indicating whether particular stimuli are, or are not, instances of the concept chosen.

Given these requirements for success, young children have rarely been found to perform very adequately on either classification tasks or concept attainment tasks. In particular young children have been found to be almost wholly unable either to reclassify the materials presented on classification tasks or to deduce the target concepts on concept attainment tasks. They have though been sometimes found to make apparently satisfactory initial groupings on classification tasks. Traditional investigators tend however to regard these initial categorisations as immature; specifically, it is often said that these categorisations are perceptually mediated whereas the categorisations of older children (from about six or seven years or so) are conceptually mediated (see, for example, Vygotsky, 1962). The main difference between perceptual and conceptual categorisations would seem to be that only in the case of conceptual categorisations are subjects held to be consciously aware of the grouping principles underlying the categorisations. Werner (1948) makes this distinction very clearly. Perceptual grouping (says Werner) is relatively automated:-

> "conspicious properties of objects themselves (color or form) quasi-automatically force similar things into groups (p.239, emphasis not in original)."

By contrast, conceptual grouping, he says, requires conscious recognition that the objects have a number of properties and that ordering may use any one.

It is important to recognise that the classical accounts do not deny that young children possess internal representations of objects of a fashion; what is denied however is that these representations are genuinely conceptual. There is a surprising measure of agreement (cf., Vurpillot, 1976b) as to the different kinds of internal representations which infants and young children are deemed to possess and their order in ontogenesis. Specifically, infants' first representations are said to be motoric; these are followed, in very early childhood, by the development of images and images are finally followed in turn by the emergence of concepts. Thus Piaget speaks of sensori-motor schemas, figurative structures and operational structures. Bruner speaks of enactive, iconic and symbolic representations respectively and at least some Russian psychologists speak of practical activity, ideal activity and conceptual imagery (Zaporozhets and Zinchenko, 1966). There are of course differences between these three accounts. In particular, the modes of representation identified by Piaget are more strictly sequential than those described by Bruner; nevertheless, so far as preschool-aged children are concerned, imagistic representations are widely assumed to be the dominant mode of representing information in memory. Images are widely held to be unstable, unsystematic and static and consequently the predominance of imagery in young children is traditionally regarded as a root-cause of their lack of deductive thought. Such children are able to use images to identify objects and pictures but the reliability of these identifications is not held to be very high. Only with developments in what has been termed the symbolic function is the child considered to gain proper concepts of objective realities which are organised into fixed and stable classes. The importance of a proper understanding of conceptual hierarchies is emphasised by both Vygotsky (1962) and Piaget (Inhelder and Piaget, 1964). Thus for Vygotsky, concepts do not become conscious until full appreciation of such hierarchies is grasped whilst for Piaget, representations of objects cannot be completely stable until they are logically arranged in their respective classes (satisfactory performance on his concrete operational tasks of class inclusion being regarded as the chief test for proper conceptual thought). Finally, it should be noted that although there is considerable disagreement as to the role of language in early conceptual development, it is fairly widely believed that language is the <u>ultimate</u> means by which stable classifications are coded and manipulated (Bruner et al, 1966; Piaget, 1951; Vygotsky, 1962; Werner, 1948).

In recent years however the relevance of the 'classical' views of concept formation for the acquisition of everyday concepts have been severely questioned. The most important criticisms have been as follows. First, the classical assumption that conceptual representations are always determinate and underwritten by a set of definitive features has been challenged (cf., Section 1.2). In particular it has been demonstrated empirically that category boundaries are not always well defined (eg., Berlin and Kay, 1969; Hampton, 1979; McCloskey and Glucksberg, 1978; see also, Lenneberg, 1957) and that some exemplars of a category are generally more representative than others (eg., Rips, Shoben and Smith, 1973; Rosch and Mervis, 1975; Whitfield and Slatter, 1979). In addition it has been pointed out that the classical views cannot handle disjunctive concepts although some doubts have been expressed (cf., Smith and Medin, 1981) as to whether many natural concepts are of this type.

A second and related criticism is the argument that attributes are not arbitrarily (or orthogonally) combined to form natural categories. In other words, attributes of objects do not occur in every possible combination with equal probability. Rather, - as has been pointed out by Rosch and her associates - there is a correlated attribute structure amongst natural objects. Rosch (1977) comments for example that creatures with feathers are more likely to have wings than creatures with fur.

A third source of criticisms of the classical views of concept acquisition has been the recent reports in the literature on language acquisition (see, for example, Anglin, 1977; Bowerman, 1977; Clark, 1973) which indicate that before they enter school, some children have learnt to use common concrete nouns (for example, 'dog', 'apple' and 'flower') to refer to roughly the same set of objects as adults use them for. These observations are not new (see, for example, Welch, 1940); however, they do indicate that young children possess considerable conceptual knowledge. In addition there is some evidence that infants (and prelinguistic infants at that) can form concepts (Ling, 1941; Nelson, 1973; Ricciuti, 1965; see also Rosch, Mervis, Gray, Johnson and Boyes-Braem, 1976).

Consideration of these and other difficulties with the classical concept formation paradigms has led to the proposition of a variety of alternative approaches. One of the least radical proposals has occurred in the literature on language acquisition where Clark's influential account of concept acquisition has retained the traditional assumption of defining attributes (Clark,1973; 1974; 1975; see also Brown, 1956; 1958a). Clark's suggestion is that concept development and the development of word meaning influence each other reciprocally; specifically, concepts are said to be acquired as children learn what words refer to. Some recent proposals in the cognitive psychological literature have also basically retained the assumption that concepts are determinate. Glass and Holyoak (1975) have, for example, suggested that findings of varying representativeness between instances of the same category and of fuzzy category boundaries are, in various ways due to processing characteristics. A more radical proposal has been made by Nelson (eg., 1974, Nelson, Rescorla, Gruendel and Benedict,1978; see also Anglin, 1977). Nelson's contention is that concepts are generated solely on the basis of function; interestingly however, she does suggest that concepts are generalised on the basis of form. Another thesis is that concepts are represented primarily in terms of separate descriptions of some of their exemplars (eg., Medin and Schaffer, 1978); alternatively, other accounts have (as was noted in Section 1.2) supposed the essence of concepts to be relational information - for example, that the roof of a house is above the walls. Then again, a number of other proposals (eg., Smith, Shoben and Rips, 1974) have adopted what might be called a probabilistic or prototypical view of concepts. These models assume that internal representations are based on the central tendencies of the concept instances to which an individual has been exposed; such models recognise that representations may possess non-necessary properties and may allow for degrees of disjunctiveness by permitting different combinations of properties to yield the same concept.

The view of the present writer is that whilst the various alternatives to the classical approaches to concept formation have at least served to broaden the fields horizons, they have, almost inevitably tended to become too polarised in outlook. To be sure, these recent proposals do, to some extent, overlap (there are similarities, for example, between the relational and probabilistic approaches); however, what is required is a much more flexible approach to the kind of concepts which develop. In particular whilst qualitative differences between artificial and natural objects have been widely commented upon, there appears to have been relatively little consideration of the qualitative differences arising between different kinds of natural object.(7) One major argument which will presently be advanced is that a consideration of the variety of everyday objects which young children evidently conceptualise strongly suggests that emphases in concept formation vary according to the kind of object conceptualised. In other words the relative balance of definitive perceptual attributes, functional information, relational information, probabilistic information and exemplar information stored will vary between different kinds of

(7) Though there has been some consideration by Garner (eg., 1970; 1974; 1978) and with regard specifically to children by Shepp (1978; Shepp, Burns and McDonough, 1980) of some of the ways in which artificial stimulus input can constrain processing options.

concept. In addition, it seems likely to be the case that, as noted above, not all the information stored in relation to a given concept will be used on every occasion the conceptual category is accessed and, more than this, it seems likely too that the bases upon which the same categorisations are made will vary even for a particular person according to the circumstances of the identification (consider, for example, the different kinds of conceptual information used in a tactual versus a visual identification of the same object).

The present concern however is with the differences in encoding which seem likely to be widespread between different kinds of object. Consider first the debate between Clark (eg., 1975) and Nelson (eg., 1974; see also Anglin, 1977) as to whether perceptual or functional cues are most important in the acquisition of concepts of concrete objects. Bowerman (1977) having reported her observations of the extensions occurring in her own children's early speech, concludes that children's natural concepts are based on a variety of both perceptual and functional similarities. In fact the cases she cites suggest there to have been considerably more evidence of extensions based on perceptual similarities than of extensions based on functional similarities. Nevertheless, if Bowerman's overall conclusion is correct, the relative importance of perceptual and functional cues would seem to be likely to vary according to the kind of object being dealt with. It should be noted in considering this issue that Bruner and Olver (1963) have distinguished two different kinds each of perceptual and functional cue respectively. In their terms, <u>intrinsic perceptual cues</u> are the properties of objects (for example, 'round and orange') whereas <u>extrinsic perceptual cues</u> derive from the positions in time or space where objects occur (for example, 'in the bowl on the sideboard'). By contrast, <u>intrinsic functional cues</u> are the general purposes to which objects may be put (for example, 'the provision of light') whereas <u>extrinsic functional cues</u> correspond to the actions performed by people in relation to objects (for example, 'people light them with matches'). It seems reasonably clear that young children do readily make certain distinctions which can only be based upon perceptual cues (for example, between certain foods). The question is however whether there are also classes of object which the child must represent primarily in terms of function. The most likely cases probably arise in relation to those classes of object whose members have very little in the way of perceptual resemblance to one another (for example, buttons or candles). Despite this it is apparent that typically, adults are able to recognise members of such classes of objects on the basis of intrinsic perceptual cues alone. This observation indicates that it is not actually clear whether or not the representations of such objects encoded by adults are indeed functionally (rather then perceptually) dominated. It does nevertheless seem reasonable to suggest though that functional cues will play an important role in the representations possessed by adults of such objects and also that the role of these functional cues will be greater in the case of the representations of such objects possessed by young children (who, it seems likely, will not have abstracted all the complicated perceptual cues necessary for the accurate identification of such objects on the basis of perceptual cues alone).

A second area where the qualitative nature of objects may influence the sort of concept acquired in relation to them arises with regard to the debates as to which of the various perceptual properties are these most used in the acquisition and generalisation of concepts. Fundamental from the point of view of the present thesis is the widely held belief that whereas shape cues are of very great importance for these representations, colour cues by contrast are of little if any importance. The relative importance of shape is stressed for example in accounts of concept acquisition in the literature on language acquisition (eg., Clark, 1975; Nelson, 1974) and, as has already been noted (cf., Section 1.2) in Vurpillot's (1976a) account of the development of the ability to judge logical identity relationships. Perhaps the main source of supportive data for the primacy of shape over colour has been that obtained by the so-called 'choice-preference' studies. The basic procedure followed in these studies has been to present subjects with a model stimulus and then to require subjects to choose between two 'choice correspondents' - each of which fails to correspond to the model with regard to one (and only one) of its properties - the 'correspondent' which is most like the model. Various perceptual properties have been contrasted in this way but the two properties most often contrasted have been colour and shape (eg., Brian and Goodenough, 1929; Colby and Robertson, 1942; Descoeudres, 1914; Katz, 1913; Suchmann and Trabasso, 1966). Young children, it is argued (eg., Tobie, 1926; Werner, 1948), are not disturbed by the ambiguity of such a task because they are only able to attend to one property at a time in any case. Tobie (op.cit.) for example, argues that young children invariably exhibit a rigid and inflexible, one-track abstraction process. More recently, Corah (1964;1966; Corah and Gospodinoff, 1966; Corah and Gross, 1967; Corah, Jones and Miller, 1966) has conducted a whole series of choice-preference studies which have been based explicitly on the premise that the results should be understood in terms of Piaget's (1950) notions of centration and decentration. The choice-preference technique has been used with both geometric coloured forms and representational materials and, in either case, it is now customary to educe that young children prefer to match by form than to match by colour. Vernon (1971) concludes, for example, that the results

> "substantiate the view that young children pay comparatively little attention to colour as such when they are concerned in the normal everyday life situation of identifying and reacting to things (p.94)."

Now as a general statement, this widely held view that young children pay comparatively more attention to shape than colour may well be correct. The question arises however as to whether shape is dominant over colour across the range of world objects or whether the relative importance of the two dimensions varies <u>systematically</u> between different kinds of object. This kind of thinking is well exemplified by the answer to a question which appeared in one of the Fringe shows at the 1981 Edinburgh Festival - 'Why' asked a pundit thoughtfully, 'do you suppose British Rail food is always served on <u>blue</u> plates?' Back came his partners reply, 'so that one can tell where the food ends and the plate begins!' Presumably the reasoning behind this couplet is that <u>even</u> British Rail could not serve blue food and that their customers, being aware that this is so, will be able to use the colour discontinuity between plate and food to distinguish between them. It certainly does seem that natural objects (and particularly plants) are rarely blue; the blue orchid for example, has eluded horticulturalists for generations. Indeed there are large numbers of naturally occurring classes of objects for which it might be expected that both children and adults would tend to attach more importance to colour correspondence than to shape correspondence (for example, grass). Additionally, there are considerable numbers of naturally (and sometimes artificially) occurring materials with a distinctive colour whose shape is, to say the least, rather nebulous (for example, sand and blu-tack respectively). Such objects and materials have not been given the consideration in the choice-preference literature that they warrant.[(8)]

A third area where the qualitative nature of objects may influence how objects come to be conceptualised arises in relation to the oft debated question as to whether shape information about concrete objects is represented internally in terms of distinctive features or prototypes. This debate parallels in some respects the old debate in the perceptual sphere between the analytic and syncretist views respectively (cf., Section 1.2). However, an increasingly wide body of opinion (eg., Bowerman, 1977; Caldwell and Hall, 1970; Vurpillot, 1976b; Williams, Fryer and Aiken, 1977) is now expressing the view that distinctive features and prototypes are complementary rather than conflicting modes of representation. As Caldwell and Hall (op.cit.) comment for example,

> "schemata are composed of distinctive features and when many distinctive features have been stored, one has a 'refined' schemata (p.7)."

Caldwell and Hall's case is perhaps most convincing with regard to object classes such as that of oranges for which there is virtually a one-to-one correspondence between a prototypical representation and the sum of the defining features. There are however other kinds of object where the match between prototypes and distinctive features does not appear to be so close.

Consider at this point the influential view of conceptual development, hitherto little discussed, which has been expounded by Rosch and her associates (eg., Rosch, 1977; 1978; Mervis and Rosch, 1981). It has previously been noted that Rosch is of the opinion

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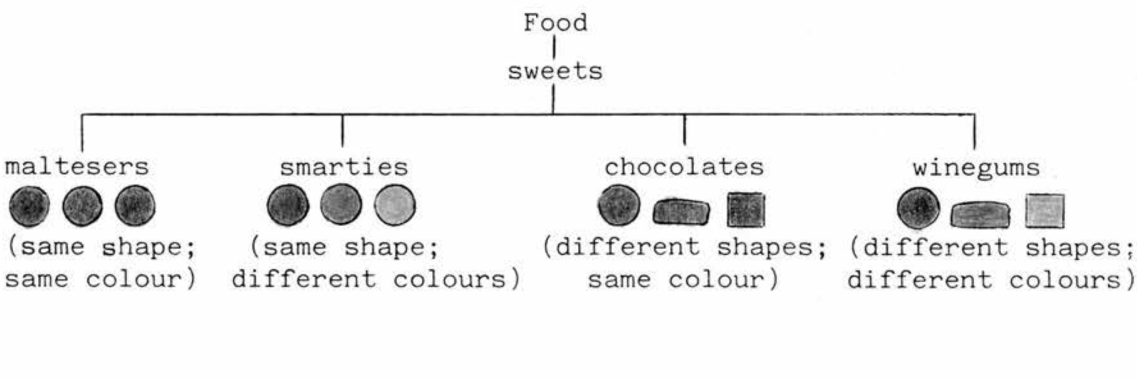
(8) Though there have, it should be noted, been a few reports in the choice-preference literature indicating that changes in the relative salience of the shape and colour differences between artificial models and correspondents does influence the properties upon which correspondence is preferred (eg., Corah, 1966; Corah and Gross, 1967).

that there is a correlated attribute structure amongst concrete objects. Rosch (op.cit.) further considers however that this correlational structure is reflected in certain basic levels of abstraction: these levels are, she says, invariably defined in terms of four inseparable aspects of the correlational structure. These are: (1) attributes in common; (2) motor movements in common; (3) objective similarities in shape, and (4) identifiability of averaged shapes. Rosch also takes the view that basic level categories tend to be internally structured into prototypes consisting of those members of the category in which this correlational structure is maximised.

One attractive feature of Rosch's notion of correlational structure is that it encompasses many of the bases identified in the various theories as important for the acquisition of concepts (ie., intrinsic perceptual cues, extrinsic functional cues, shape and shape prototypes respectively). From the present point of view however, the drawback of Rosch's account is that these diverse bases are held to be <u>inseparable</u>; specifically, as has been noted in the last few paragraphs, there does appear to be considerable variety in the bases upon which categories are primarily established. Thus, some classes of object will have few if any attributes in common (eg., buttons), other classes of object will not be acted upon with any particularly differentiating motor movements (eg.,various foods) and other classes of objects (particularly liquids and materials) will have no shape in common. Reconsider at this point the question raised above as to whether the products of the sum of the defining features of a class of objects are always equivalent to prototypical representations of the same object classes. One finding reported by Rosch et al., (1976) is that adults spontaneously classify objects such as birds and fish at a level of classification which is one level higher than that which - according to the four criteria of correlational structure - is the basic level. Rosch et al., attribute this finding to their subjects' ignorance of the pertinent correlational structures. This suggestion may well be correct; however a more fundamental explanation of this finding is that the factors which differentiate the various kinds of birds and fish are more <u>subtle</u> than the factors by which other kinds of object may be distinguished. The particular factors involved would appear to be distinctive features. Consider by way of comparison the case of terrestrial mammals. It is evident that these animals are typically classified and named at the level of the genus (ie., horse, cow, etc.). The most obvious reason why terrestrial mammals are so widely distinguished from each other appears to be that they have distinguishing features which are much more marked than those differentiating different kinds of birds and fish. In particular, terrestrial mammals have highly developed sensory receptors positioned close to the brain which in forming their heads seem likely to be particularly informative clues as to identity; the differentiation of the heads of different kinds of birds and fish respectively are by contrast, much less marked. The crux of the present argument is then that whereas the representations of objects such as horses and cows tend to involve both prototypical and featural information, the representations of other kinds of object (eg., those of birds and fish) are more completely prototypical. In other words, different objects will vary in the extent to which they are represented by distinctive features and prototypes. It follows from the present suggestions that prototypes may tend to carry information which is more superordinate than that carried by distinctive features. This suggestion relates specifically to Evans' (1967) proposal that prototypes tend to be used on classification tasks whereas distinctive features tend to be used on discrimination tasks.

Rosch's approach to category development is of very great relevance to this thesis. One final example of its limitations should therefore be given. Consider the taxonomy illustrated in Figure 6. It is evident that the four criteria defining Rosch's

Figure 6 To illustrate some of the limitations of Rosch's approach to categorisation (see text).



'basic levels' of categorisation (which amount basically to a marked similarity of attributes - particularly shape - and extrinsic functional cues) cannot specify which level of categorisation in this taxonomy is the basic one. The movements made in relation to these objects are highly positively correlated at each level and are certainly little more highly correlated at the level exemplified by 'maltesers' than that of 'sweets'. Alternatively, when the attributes of shape and colour are considered, it is apparent that neither the colour values nor the shape values are positively correlated in all the categories at any level. The inability of Rosch's criteria to specify the basic level in this taxonomy appears to stem largely from the fact that when she developed her criteria, Rosch did not consider a suitably representative range of taxonomies (despite her claims - cf., Rosch et al., 1976 - to have done so). It therefore follows that Rosch has overestimated the amount of correlational structure in the world and that the psychological bases which are used to represent concrete categories are, - though by no means arbitrary, - much more varied than she suggests. Thus it seems likely that categories which arise in relation to concrete objects may be based upon any one or a combination of Rosch's psychological bases and that indeed, additional factors may be involved as well (eg., the tastes, sounds, movements and intrinsic functions of objects). In the present view then, there is no single object originating factor (or limited set of factors) which is either necessary or sufficient for the conception of all the objects in the everyday world.

One critical question which arises from the present view is that of how children manage to learn the various categories of objects in the world when, as has been suggested, these categories have a very wide range of bases. It is strikingly apparent that the only factor which consistently unites the members of each of these categories is that customarily they all share the same name. Now this observation does not of course necessarily implicate language in cognitive development. To be sure, there is a considerable body of opinion which takes the view that concept acquisition is, in some way mediated by language development (eg., Brown, 1956; 1958a; 1958b; but see also Brown, 1976; Bruner, 1974; Clark, 1975; see also Werner, 1948). However, there is an equally distinguished lobby which denies that language has an important role in conceptual development (eg., Lenneberg, 1967; Macnamara, 1972; Nelson, 1974; Piaget, 1968b). The latter view does, moreover, derive some support from the demonstrations (cited above) of concept acquisition by prelinguistic infants. Certainly, it does seem unwise to cling to an extreme version of the Whorfian view (that is, the view that the categories a person thinks with is determined by the particular language he speaks). What does not seem to be in any doubt however, is that concepts ultimately become thoroughly attuned with the categories inherent in language. Language is the means by which conceptual information becomes structured and, in particular, it provides a means of transmitting obscure categorial information of various kinds. Thus language serves both a discriminative role, that is, it serves to distinguish categories which might not otherwise be differentiated (such as, for example, horses from donkeys, sheep from goats or, as James (1890) suggests, claret from burgundy) and it also serves a grouping role, that is, it unites objects which might not spontaneously be co-categorised (consider, for example, the visual, auditory and tactile differences between chihuahuas and great danes, yet children learn to label both these breeds as 'dogs').

Perhaps the central question then concerns the stage in development at which concepts begin to become stabilised in terms of language categories. Classical views tend, as has been noted, to assume that this is a relatively late development; Piaget, for example (cf., Berlyne, 1964; Flavell, 1963) has suggested that words are used in reference to a variety of meanings varying greatly with context during the preschool years. There is however, now considerable evidence that children have learnt to use language to refer to a considerable number of fairly stable classes by five-years or so at the very least (cf., above). So then, the critical question becomes whether stable knowledge of these classes develops any earlier than five-years. In this connection it is interesting to consider Clark's reports that the close of the period of widespread extensions (at about thirty months) is -

> "generally marked by a large increase in questioning activity (of the 'what(s) that?' type) combined with a rapid growth in vocabulary (1974, p.110, 111)."

It seems possible that, having made various attempts to name new objects on the basis of a wide variety of perceptual and functional cues and been constantly corrected (ie., because names are not consistently correlated to any great extent with any single such characteristic or set of characteristics), children learn to ask for the names of objects directly. It seems likely that in taking this interest in the names by which things are called, young children do, at least to some extent, appreciate the power of language as a categorial system. Certainly, casual observation would tend to confirm that children steadily acquire a considerable number of reasonably stable linguistic-conceptual categories in their preschool years.

The traditional view that young children do not acquire stable categories which are coded in language is closely linked with the more general discussion of the age at which children acquire an awareness of the arbitrary nature of symbols.[9] In particular, it is traditionally held (eg., Greenfield and Bruner, 1974; Piaget, 1929; Vygotsky, 1962 and Werner, 1948) that up to at least five or six years or so, children are nominal realists; that is, that failing to appreciate that symbols are arbitrary, they believe the name of an object to be inside or in some way attached to the referent object. The tasks which have yielded the evidence for nominal realism are however, fraught with difficulties arising from uncertainties as to whether subjects have actually understood that they are required on these tasks (no doubt for the first time in their lives) to treat names independently of the referents to which they habitually refer. Most importantly, several recent studies (Ianco-Worrall, 1972; Osherson and Markman, 1975) have found that when young children are asked questions of the form:- "Suppose you were making up the names for things, could you then call a cow 'dog', and a dog 'cow'?" - they do evidence some understanding of the arbitrary character of words. Additionally, Hollobow (1981) reports that in a study of children's appreciation of the lexical ambiguity of homonyms, the majority of her two-year old subjects appreciated that the same names may be used to refer to two completely different

(9) Interestingly, a study by Klank, Huang and Johnson (1971) has yielded some evidence which disconfirms the assumption that the sound quality of concrete words is completely arbitrary. Specifically, Klank et al., obtained evidence suggesting that concrete words to some extent reflect qualitative characteristics of the objects they denote (see also, Werner, 1948).

kinds of object.

One outstanding question remains to be discussed. Specifically, at what level of abstraction (if any) does conceptual knowledge tend to be first acquired? In the past the dominant views (cf., Brown, 1958a) have been that initial concepts are either very specific or else very superordinate and that conceptual knowledge is progressively extended either to more superordinate or to more specific levels of abstraction, respectively. More recently Rosch, (eg., 1977, 1978), has cogently argued that children first acquire concepts at what she calls the basic level of abstraction (an intermediate level of abstraction roughly equivalent to that denoted by common nouns such as 'dog' or 'cat'). Rosch's proposal is not entirely new. In particular a number of writers have previously suggested that the child's world is generically organised and this generic level of abstraction (see, for example, Brian and Goodenough 1929; Brown, 1958a; Bruner, 1957) would seem to correspond closely to Rosch's basic level of abstraction. One attraction of the kind of view propounded by Rosch is that it appears to accord closely with the nature of language development; that is, basic (or generic) level names appear to be the kind of category labels first acquired by children (see, for example, Anglin, 1977, Rosch et al., 1976). Rosch herself (eg., Rosch et al., 1976) rejects the possibility that the development of these categories could be 'simply' a function of language development and contends that the main basis for their acquisition are the four psychological criteria she identifies as accounting for real world correlational structure. Now clearly, language could not be the sole means by which categories are acquired; names are, in general, virtually arbitrary and must therefore generally derive their meaning from the psychological factors with which their referents have come to be associated. However, as has been seen, Rosch's psychological criteria alone are unable to account for the development of knowledge of all basic level categories. In the present view therefore, language is held to be involved from the early preschool years onwards in mediating the acquisition of stable concrete categories (and, most especially the 'basic level' categories). It is through learning the terms given to objects that children are able to grasp the particular psychological bases (ie., perceptual, functional, etc.) of the various concrete categories.

Whilst however it seems probable that the first comprehensive and stabilised set of categories acquired by children will be categories at the 'basic level' (or its linguistic equivalent) it does also seem likely that young children acquire some categorial knowledge at other levels of abstraction. In particular there does seem to be fairly convincing evidence that young children acquire some categorial knowledge at levels of abstraction higher than that of the basic level. Figure 7 illustrates five levels of abstraction identified by Welch (1947) in which level two 'that is 'dog')

Figure 7 Taxonomy described by Welch (1947)

'Substance'	-	abstraction level 5
'Living Substance'	-	abstraction level 4
'Animal'	-	abstraction level 3
'Dog'	-	abstraction level 2
'Collie'	-	abstraction level 1
'this dog'	-	object, concrete level.

corresponds to the level identified by Rosch as the basic level. Interestingly, Anglin (1977) reports specifically that children typically learn the term 'dog' before either that of 'collie' or 'animal'. Nevertheless, whilst Günther Stern (aged eighteen months) was able, when given various animal nouns, to point correctly to many of the appropriate pictorial correspondents, he would, when producing the names himself, name almost all of the animals as 'bebau' - which suggests that he had in some way grouped all these animals together (reported by Werner, 1948). More precise evidence that young children acquire categorial knowledge at levels of abstraction higher than that of the basic level has been obtained by Goldberg, Perlmutter and Myers (1974). These researchers found that children as young as two-years evidenced some knowledge of superordinate categories in the order in which they recalled categorically related versus categorically unrelated items.[10]

1.4 Overview of the issues addressed by the studies reported in this thesis

1.4.1 Résumé

The overall area of investigation is that of young children's performance on a variety of identification tasks involving repres-

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(10) N.B. The present thesis is concerned with abstractions at the basic level and at levels of abstraction higher than the basic level. These abstractions each involve the making of categorisations between different things. This thesis is not concerned with the kind of concept involved when recognising an individual object despite a change in its outward appearance and/or inward state (eg., recognising a person as the same person over time despite changes in appearance).

entational materials (cf., Section 1.1). In Section 1.2 a number of studies were reviewed which, in the past have been supposed to indicate that young children perform poorly on such identification tasks because, rather than co-ordinating the various visual cues they tend, instead, to centre their attention upon specific, salient features of the material. Several limitations of these studies were discussed and it was suggested that young children may not perform poorly on these tasks because of a lack of co-ordinative skill per se. In particular it seems likely that young children often lack the specific conceptual knowledge which is required for success on these tasks. The concepts of objects which young children seem likely to possess was discussed in Section 1.3. This discussion raises a number of possibilities concerning various kinds of identification tasks upon which young children may succeed. The present series of studies investigated some of these possibilities. The studies conducted are reviewed in the following sections.

1.4.2 Preschool children's judgements of correspondence between objects and pictures of those objects

Chapter Two reports two studies which have investigated how young children judge correspondence between highly specified objects and pictures of those objects. It should be stressed at this point that the relation which exists between an object and a picture of that object is very different from the kind of relation which may exist between an object and a picture per se (or between sets of objects or sets of pictures, respectively). Specifically, whereas in the case of ad-hoc object-picture pairs it is reasonable to judge correspondence at a number of different levels of abstraction, in the case of pictures of specific objects, correspondence is only reasonably judged at the level of abstraction at which the object is specified. For example, a model of a Red Setter and a picture of an Afghan hound could be legitimately grouped together as equivalent on the basis that both are dogs, indeed, the model of the Red Setter could also be legitimately grouped with a picture of a cat on the basis that both are animals; it is not however reasonable to accept a picture of an Afghan hound (and even less so,a picture of a cat) as a legitimate picture of the Red Setter.

It follows from these considerations that subjects who fail to judge the correspondence between objects and pictures of those objects at the level of abstraction at which the objects are specified have failed to judge such a correspondence satisfactorily. The available evidence would appear to indicate (cf., Sections 1.2 and 1.3) that young children are incapable of making accurate judgements of logical identity. This evidence - chiefly that obtained by Vurpillot in her studies of the development of identity relationships - was gained however on studies in which children judged correspondence between picture pairs. By contrast, in the studies reported in Chapter Two, preschool children were asked to judge correspondences between objects (highly specified) and pictures of those objects; this may be significant because, as has just been observed, the latter kind of comparisons would seem especially likely to elicit judgements of correspondence at the level of logical identity.(11)

As it was noted in Section 1.2, besides denying that young children can judge logical identity satisfactorily, Vurpillot has also denied that young children can judge logical classes of equivalence. A consideration of recent advances in the area of category and concept acquisition suggests however (cf., Section 1.3) that it is unreasonable to assume (as Vurpillot does) that a category is not logical simply because the class members are not subordinated to a given attribute or set of attributes. Instead, it seems rather to be expected that a comprehensive understanding of natural categories will be evidenced by a considerable <u>flexibility</u> in the bases (perceptual and/or functional) upon which categories are judged to be based. Two issues then were investigated by the studies reported in Chapter Two. The first of these was whether there is any evidence that preschool children can judge shape and colour correspondence between highly specified objects and pictures of those objects at the level of logical identity. The second issue was whether, when making such judgements in terms other than logical identity there is any systematic flexibility in the kinds of correspondence which young children deem acceptable; in particular, these studies investigated whether children judge the relative importance of shape and colour respectively to vary between different kinds of object and whether any such flexibility is

(11) Clearly the use of the phrase 'logical identity' here is not meant to imply that an object and a picture may legitimately be judged to be identical; rather what is meant is a judgement of correspondence which requires that a picture of an object be a fully accurate two-dimensional representation of that object.

structured in terms of the names by which pictured objects may be legitimately called. It should be noted that these studies also examined how children's correspondence judgements vary according to whether the model objects are presented physically or are described at the level of the noun phrase.

1.4.3 Preferred picture groupings of preschool children and adults respectively

Although judgements of correspondence between objects and pictures of those objects may reveal something about the nature of subjects' concepts of those objects, such revelations (as will become evident) may not always be clear-cut. Chapter Three reports two studies which have, by using more classical procedures for investigating conceptual organisation, followed up more directly the hypothesis reached in Section 1.3 that whilst categories have various bases, they become structured from early on in development in terms of the names by which things are called. The first of these studies (cf., Section 3.2) was conducted with preschoolers and the second (cf., Section 3.3) with adults.

1.4.4 Further investigations of linguistic effects in preschool children's correspondence judgements

Two studies are also reported in Chapter Four. The first of these (cf., Section 4.2) investigates how young children judge the importance of what an object is called relative to its visual-perceptual and functional characteristics respectively. As previously indicated (Section 1.3) varying claims have been made as to whether perceptual or functional aspects are primary in concepts; an alternative view however (confirmed by the outcome of the studies reported in Chapters Two and Three) is that because the relative importance of each of the perceptual and functional aspects of concepts varies greatly between different kinds of concept, neither the perceptual nor the functional aspects can really be said to be primary and that rather, from early on in development it is the linguistic factor which is of widespread importance in categorisation.

One possible influence upon correspondence judgements is the function (if any) to which the correspondent is to be put. In each of the studies reported in Chapters Two and Four the correspondents served the function of illustrating the contents of boxes (one model object was inside each box and one correspondent could be placed on top of each box). Now in the first three correspondence studies (reported in Sections 2.2, 2.3 and 4.2, respectively) the object models presented were very dissimilar from each other (perceptually, functionally and linguistically) and consequently it seems reasonable to suppose that the correspondence judgements made in relation to these models would be fairly spontaneous and not systematically biased and that they would indicate pretty accurately what each subject considers to be the most satisfactory correspondents of each model object.

By contrast however, in the second study reported in Chapter Four (cf., Section 4.3) the composition of the sets of object models was so manipulated that subjects were required to lay aside their spontaneous correspondence preferences if they were to satisfy the informational demands of the task. Thus whereas the earlier correspondence studies investigated children's spontaneous notions of what makes for a satisfactory correspondent, this study investigated children's ability to use correspondents much more in the role of symbols. It is evident (cf., Section 1.3) that such a task is more in line with traditional notions of how to measure children's potentiality for conceptual thought than are the more spontaneous tasks. One particular concern of this sixth study was to examine whether children's ability to satisfy the informational demands of the task is in any way influenced by how, if at all, the model objects are described.

1.4.5 Preschool children's ability to detect anomalies and ambiguities respectively

Chapter Five reports an examination of young children's ability to detect anomalies and ambiguities in pictorial material when no specific object models are presented and when, therefore, subjects' judgements must be based upon their knowledge of how particular kinds of object may and may not appear in the real world. As indicated in Section 1.2, young children have been widely reported to perform poorly on such tasks and these results have been supposed to support the traditional view that preschoolers are somewhat limited in their ability to co-ordinate information. These studies have however generally failed to take account of the kind of knowledge possessed by subjects about the types of object depicted and they have failed also to provide subjects with an adequate description of the special nature of the materials. The study reported in Chapter Five takes account of both of these limitations.

The focal concern of the present studies then is to investigate the ability of young children to co-ordinate diverse sources of information when performing various identification tasks with representational materials. These abilities, it has been suggested, may have been underestimated in the past because of a general failure to appreciate the kind of co-ordinations which are likely to occur. In particular, it has previously been customary to suppose that children's lack of co-ordination is evident from the extent to which they tend to centre their attention upon single sources of information. The present proposal however, is that so-called 'centering' does not necessarily result from a lack of co-ordinative skills per se. In the following experimental chapters (that is, Chapters Two-to-Five) data will be presented which will be interpreted to suggest that, in a variety of circumstances, preschool children's centering processes yield evidence of considerable co-ordinative skill.

CHAPTER TWO: PRESCHOOL CHILDREN'S JUDGEMENTS OF CORRESPONDENCE BETWEEN OBJECTS AND PICTURES

"'Perception as a faculty,' Aristotle says elsewhere, is of 'the such' and not merely of a 'this somewhat.'" Rudolph Arnheim, 1969 (p.9).

2.1 Introduction to the issues for investigation with special reference to the choice-preference literature

The present chapter reports two studies which have each investigated how young children judge shape and colour correspondence between objects and pictures of those objects. Of particular relevance to this topic is the enormous number of choice-preference studies (in excess of forty) which have investigated children's preferences for shape versus colour correspondence. This literature will be considered in some detail in the present section.

The first point of interest concerns the widespread assumption that young children cannot attend more than a single kind of correspondence simultaneously and that consequently they are unable to judge logical identity accurately. This assumption provides the whole rationale for the investigation, via the choice-preference method, of whether young children abstract shape before colour or colour before shape (cf., Section 1.3). An important question which arises however is whether this assumption that young children cannot judge logical identity on such tasks is justified. There has been little previous consideration of this question. Interestingly however, Descoeudres (1914) in reporting one of the earliest choice-preference studies conducted, comments that faced with the critical choice between a colour-only correspondent and a shape-only correspondent, 'some children reply to you that there is not a card which is the same (p.308)'.(1) Descoeudres fails to indicate either the number or the age of the children who made these observations; however her remark does raise the possibility that it may be erroneous to assume that young children cannot attend to more than one dimension of correspondence at a time. An experimental test of this assumption (to the present writer's knowledge the only such test) was made by Colby and Robertson (1942). These

(1) Literally, "Certains enfants vous répondent qu'il n'y pas de carte 'la même chose'". Descoeudres indicated that her reply to such observations was: "'Montre-moi une carte qui ressemble un peu, qui est un peu la même chose'. (p.308)."

investigators found that when an absolute concordant (that is, a choice stimulus corresponding to the model stimulus on both shape and colour) was included together with the shape-only-discordant and colour-only-discordant options respectively, children as young as forty-four months evidenced a preference for the absolute concordant, thus giving some evidence of multiple abstraction. As Colby and Robertson (op.cit.) observe, such performances, -

> "do not support the claim (ie., by Tobie, 1926) that young children invariably show a rigid, inflexible, 1-track abstraction process (p.400 emphasis in original."[2]

The question of the extent to which young children can judge shape and colour correspondence simultaneously is clearly an important one and was the first question examined by the present investigations.

The second issue with which the present studies are concerned is a systematic investigation of children's preferences for shape correspondence relative to colour correspondence. As has been previously noted (cf., Section 1.3) it is now customary to conclude from the choice-preference literature that young children's preferences are for shape rather than colour matching (Clark, 1974; Vernon, 1971; Vurpillot, 1976a). It becomes apparent upon closer inspection however that this conclusion is not consistent with the results of a considerable number of the choice-preference studies. In particular many of the early investigations (eg., Descoeudres, 1914; Katz, 1913; Volkelt, 1926) found that children's preferences were, at least for geometric materials, for colour rather than shape correspondence. In order to account for these findings it has been suggested by some (Corah, 1966; Vurpillot, 1976a) that there has actually been an historical shift in children's preferences towards a greater preference for shape correspondence relative to colour correspondence. Corah (op.cit.) observing that Descoeudres (op.cit.) and Tobie (1926) each attributed their finding that preschool children

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[2] N.B. Colby and Robertson do nevertheless conclude their results to be in general agreement with Tobie's claim that young children do not recognise identity and, in consequence, this study is sometimes cited in support of the traditional assumption that young children cannot perform multiple abstractions; such citings fail however to give due weight to Colby and Robertson's own qualifications of their results.

preferred colour correspondence for geometric but not representational materials to the lack of meaning that artificial shapes held for their subjects, suggests that contemporary children have much more experience with shape orientated educational toys than their forbears did and that this experience leads them to pay more attention to shape than has been given by children in the past. Vurpillot (op.cit.) makes the same point. The evidence that there has actually been an historical shift in children's correspondence preferences is however by no means irrefutable. Significantly, Serpell (1969) in reviewing eight of the most prominent choice-preference studies has concluded that there is no simple chronological trend and that rather, individual children normally graduate from a preference for colour to a preference for shape.(3) It seems very unlikely however that the dispute as to whether or not there has been an historical shift in children's preferences for shape versus colour correspondence, will ever be satisfactorily resolved. The reason for this is that only in some of the more recent studies is a precise specification given of the colours and shapes presented and that since the relative salience of the particular shape and colour differences between the model and choice stimuli are known to have systematic effects upon correspondence preferences (Corah, 1966; Corah and Gross, 1967; Huang, 1945) the effects of stimulus factors and of differences in methodology are irretrievably confounded. Indeed, given these latter results it does seem especially apparent that there are strong grounds for doubting whether shape is indeed as primary over colour in attentional terms as has been concluded by some recent reviewers.

Nevertheless, although some contemporary observers may have overstated the case for young children having a general attentional bias for shape relative to colour, there is no evidence that this case has been overstated insofar as the choice-preference results obtained with representational models (ie., as distinct from coloured geometric models) are concerned. Specifically, the studies that have examined choice-preference performance with representa-

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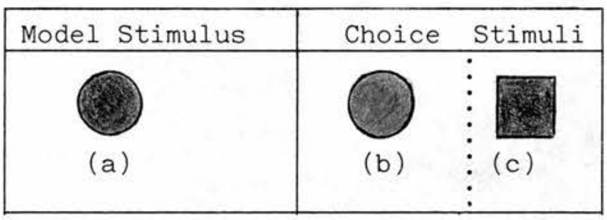
(3) It should be noted however that the studies reviewed by Serpell appear to be unrepresentative of the choice-preference literature as a whole; specifically Serpell omits to consider those studies (eg., Corah, 1966; Kagan and Lemkin, 1961; von Kuenburg, 1920) which found shape preference to be dominant in early childhood.

tional models (ie., Descoeudres, 1914; Huang, 1945; Segers, 1926b; see also Eljasch, 1928; Katz, 1913; Serpell, 1966; Tobie, 1926) have found very little evidence that colour correspondence is ever generally preferred to shape correspondence when representational models are used.[4] A critical question is however, whether these results are definitive. In the present view, great stress is laid upon the need to consider correspondence preferences as a function of the kind of object serving as model. In particular it has been suggested (cf., Section 1.3) that the relative importance of shape and colour correspondence respectively, may be judged to vary systematically according to the kind of object serving as model. It may be then that the studies of children's correspondence preferences which have used representational models, have been too restricted with regard to the kinds of object which have been used as models to yield a fair assessment of children's correspondence preferences in relation to such models.

Consider at this point the choice-preference array shown in Figure 8. Suppose that stimulus (a) constitutes the model object

Figure 8 To illustrate some influences upon how the relative importance of shape versus colour correspondence is judged (see text).



and that it is requested that the choice be made as to which of the two remaining stimuli (ie., (b) or (c)) is most like it. It seems likely that the choice made will depend to some extent upon what the model is called. If, for example, the model stimulus (a) is called, 'a smartie' it seems reasonable to suppose that there will be a greater probability of stimulus (b) being chosen than when the model is called 'a chocolate'. The most reasonable explanation of

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[4] Only Huang (1945) and Katz (1913) found any evidence of systematic preferences for colour correspondence relative to shape correspondence.

this effect[5] is that categorial knowledge of the category referenced by the model name governs the choices made; specifically, the tendency is to choose (independently of shape or colour correspondence per se) the choice stimulus which portrays something which could be the same kind of object as that indexed by the model name in preference to the stimulus portraying something which could not be the same kind of object as that indexed by the model name. It follows from this that the knowledge people possess about how members of object categories may appear will be likely to have strong, systematic and spontaneous effects upon judgements of visual correspondence.

The idea that general or class cues are emphasised in perception appears to have a long heritage. Arnheim's comment, cited at the 'head' of the present chapter constitutes an exposition of the view expounded by Aristotle. It means, essentially, that,-

> "We always perceive in the particular kinds of thing, general qualities rather than uniqueness (Arnheim, 1969 p.9, 10; emphases not in original)."

More recently(!) the theories of Bartlett (1932), Bruner (1957) and Vernon (1954) have stressed the role of concepts and categories in perception.

The present proposal is then that children and adults may, (if they possess the categorial knowledge required) systematically judge the relative importance of shape and colour correspondence to vary according to the kind of object serving as model. This suggestion does of course raise the question as to why so few choice-preference studies have found representational object models to elicit any preference for colour correspondence relative to shape correspondence (cf., above, present section). One observation which can be made is that the pertinent studies have tended to present only model objects for which the categorial identity is mediated by shape. This observation may be highly significant if it is also the case that the pairs of choice stimuli offered have each comprised a colour discordant which shares the same categorial identity as the model and a shape discordant which does not accord with the categorial identity of the model. Typically these studies have not given sufficient information about the choice stimuli for this to be determined. However, in the case of two studies

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(5) N.B. This account is based on a study carried out with adults by the present writer (cf., Section 3.3 for a full report).

(Descoeudres, 1914 and the replication of Descoeudres' study by Segers, 1926b), sufficient information is given and, moreover, it is evident that the categorial identity of the choice-stimuli has been confounded with the dimensional discordances. Specifically the subjects in these studies were required to choose between shape correspondents (ie., colour discordants) of the same categorial identity as the model (pot, basket, bottle and lamp respectively) and colour correspondents (ie., shape discordants) with a different categorial identity to the model.

The present hypotheses concern the relative acceptability of different pictures as pictures of particular objects. Crucially these hypotheses contrast two kinds of object characteristic. (These characteristics are referred to later as dimensional values.) Firstly there are those characteristics of an object that are implicit in the noun by which this object is customarily called. These characteristics are possessed by all the objects which may be referred to by the same noun; for example, balls are always round. Secondly, there are those characteristics of an object that are not shared by all the objects which may be referred to by the same noun; for example, different balls are differently coloured. The central hypothesis is that, for a given object:

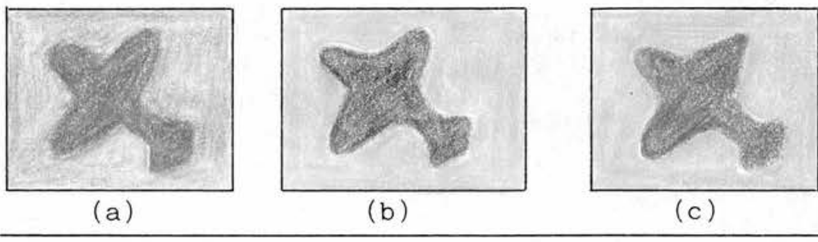
> "correspondence with regard to dimensional values that are implicit in the object noun will generally be judged to be more important than correspondence with regard to any value which distinguishes the object at a lower level of abstraction".

Thus, for example, it would be hypothesised that for a red ball, shape correspondence will be preferred to colour correspondence whilst, for a tiger in a standing posture, colour correspondence will be preferred to postural correspondence. In the present view therefore, it is considered that young children's object categories are likely to be grounded in a variety of bases of equivalence - which, so far as shape and colour respectively are concerned, may include either shape or colour correspondence (or even both shape and colour correspondence or neither shape nor colour correspondence) - but, it is held, these diverse bases of equivalence are systematically structured in terms of the names (eg., 'ball', 'tiger', etc.) by which objects are customarily called (cf., Section 1.3). The level of abstraction denoted by such names corresponds very closely to the basic level names described by Rosch; however, by making the linguistic aspect of these categories criterial the present hypothesis avoids the shortcomings of Rosch's psychological definition of basic level categories and, in particular, avoids the limitation that colour correspondence may be assumed at this level of abstraction (cf., Section 1.3). So as to clearly differentiate the system of categories presently being proposed from those which Rosch identifies, the present category names will, in this thesis, be referred to as 'type names'. The hypothesis outlined above will therefore be referred to as the 'type hypothesis'. The range of dimensional values implicit in a type name (for example, a very limited range of values occurs in the case of the colouring of tigers whereas a rather wide range of values exists in the case of the shapes of shoes) will be referred to as type-defining dimensional values (abbreviated, 'type-defining values'). By contrast, the dimensional values which vary between different members of a given type of object and are not implicit in the type name (eg., the values for the type 'ball' include an almost infinite variety of sizes and colours) will be referred to as type-modifying dimensional values (abbreviated, 'type-modifying values').

In addition to the general argument that young children's object categories comprise many varied perceptual (and also functional) bases but are systematised in terms of language (cf., Section 1.3) there is some more specific evidence which supports the present proposition that young children will exhibit a preference for correspondence with regard to type-defining values to correspondence with regard to type-modifying values independently of shape or colour correspondence per se. This evidence derives from a study which is reported in the drawing literature. Traditionally (cf., Luquet, 1913; 1927; Piaget and Inhelder, 1969) young children have been regarded as intellectual realists (drawing what they know) whereas older children have been supposed to be visual realists (drawing what they see). Most importantly however, Barrett and Light (1976) have observed that the notion of intellectual realism is ambiguous because it does not specify whether the young child draws what he knows about the individual object or what he knows about the object's generic type. When moreover Barrett and Light (op.cit.) investigated this issue empirically (by presenting children with specific objects to draw) they found that by far the most numerous kind of drawing over the age groups studied (which ranged from 66 to 78 months) was symbolic drawings; that is, the children tended to draw what they knew about the genus of the object presented rather than either what they knew about the individual object presented or what they saw when the individual object was presented to them. This finding clearly provides strong support for the present type hypothesis.[6]

In advancing the type hypothesis it has been argued that young children may, in judging correspondence, be especially sensitive to the dimensional values implicit in common nouns. The third and final major issue examined by the present studies concerns the effect upon young children's correspondence preferences of describing model objects at the level of the noun phrase either instead or else in addition to presenting the object physically. Now it is well known that verbal labels may exert a very considerable influence upon how older children and adults will perceive and reproduce ambiguous stimuli (eg., Bartlett, 1916; Carmichael, Hogan and Walters, 1932; Gibson, 1929; Luchins, 1945). What is not so often noted however is that there is also evidence that the perceptions of young children too may be sensitive to precisely how stimuli are described. In particular Luria (1961) has reported a number of experiments which have demonstrated that by drawing attention to particular properties of objects, speech may substantially modify natural patterns of salience and thereby alter young children's perceptions. In one of these experiments three-and four-year-olds were taught to respond differentially to two stimuli (stimuli (a) and (b) respectively in Figure 9) and were then presented with a third stimulus (stimulus (c) in Figure 9). The response obtained for the third stimulus was the same as that elicited by stimulus (a) which indicated that the children had based the initial distinction between stimulus (a) and stimulus (b) upon the figures

Figure 9 Reconstruction of some stimuli presented in a study described by Luria (1961) - see text.



[6] It should also be noted that interestingly, both Descoeudres (1914) and, rather more explicitly, Serpell (1969) have suggested that children's correspondence preferences for representational objects on choice-preference tasks may be mediated by the names by which the stimuli offered may be called. Neither Descoeudres nor Serpell suggests however that colour as well as shape cues might be codeable by language.

and not upon the grounds. When however meaningful information was given to the children which drew attention to the grounds - for example, 'the plane can fly when the sun is shining and the sky is yellow' and 'when it's rainy the plane can't fly and has to be stopped' - an overwhelming majority of the children were found to respond to the backgrounds rather than the figures.

Another of the studies described by Luria (op.cit.) and also a more elaborate study carried out by Babska (1965) investigated the ability of infants and young children respectively[7] to distinguish target boxes from non-target boxes by remembering the characteristics of the box covers. These studies each found that the introduction of names for the covers on the boxes (eg., colour names) greatly facilitated successful discrimination of the target boxes.

Luria (op.cit.) has proposed on the basis of the findings he reports that one development in early childhood is that of a verbal control on behaviour. This development begins when the child's behaviour becomes modifiable by the speech of others and subsequently the child begins to be influenced by his own overt speech before finally, he becomes able to determine his own behaviour by using covert speech in a deliberate and conscious fashion. Babska too (op.cit.) concludes that speech plays a prominent role in structuring the attention paid by young children to the various properties of objects.

Reconsider at this point the choice-preference array illustrated in Figure 8 (p.45). Ponder what might happen if stimulus (a) were to be called 'a brown smartie' rather than 'a smartie'. It does seem reasonable to suppose - in view of the findings reported by Luria (op.cit.) and Babska (op.cit.) - that young children would be more likely to choose the choice stimulus corresponding to the type-modifying value if the model were to be described as 'a brown smartie' rather than as simply 'a smartie'. A parallel effect would be expected to occur if the model were to be called 'a round chocolate' instead of 'a chocolate'.

To summarise this section so far. The present studies address three issues. These are:

(1) Whether young children evidence a preference for absolute concordants relative to 'correspondents' which are actually

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[7] N.B. The subjects in the study described by Luria were twelve-to-thirty months; the effect reported by Babska typically occurred at about thirty months.

discordant with regard either to shape or colour.

(2) Whether when objects are physically presented young children judge the relative importance of shape and colour correspondence respectively to vary systematically according to the type of the objects presented such that discordance on a type-modifying value will be preferred to discordance on a type-defining value independently of shape or colour correspondence per se.

(3) Whether when, instead of being physically presented, objects are described at the level of the noun phrase, there is a shift from a relative preference for correspondence with regard to the type-defining values to a greater preference for correspondence with regard to the type-modifying values.

In addition it should be noted that although the present studies are primarily concerned with investigating children's correspondence preferences for type-defining values and type-modifying values respectively, there are at least two kinds of object type where a contrast between type-defining and type-modifying values is impossible. Thus, some object types (eg., winegums) may possess no substantial type-defining values whilst other object types (eg., maltesers) may possess no substantial type-modifying values. Children's correspondence preferences in relation to both these kinds of type were also investigated in the present studies.

It was suggested in Section 1.4.4 that judgements of correspondence between objects and pictures may be expected to vary as a function of the use (if any) to which the picture is to be put. In the present studies the pictures served the function of illustrating the contents of a retail package. This function was selected because it does seem likely that children will expect the contents of a retail package to correspond closely with any picture(s) on the outside of the package. In the course of a discussion on this topic MacDonald (personal communication, 1982) recalled the true story of an Indian visitor to Britain who bought a box of crackers and was disappointed to find that the box failed to contain the cheese and salad which had been featured in the pictorial illustration on the outside of the box. In a similar vein, Donaldson (personal communication, 1981) related the story (allegedly true) of a tribe of cannibals in some far away land who, not so many years ago were visited by some young missionaries and their families. Not a little apprehensively the missionaries sought gently to modify the cannibalistic habits of their adopted flock, but having little success, they eventually decided to confront the cannibals' chief directly. The chief however was indignant, accused them of being hypocrites and then frog-marched them to the tip where the everyday waste was dumped. There he gesticulated to a number of food tins strewn around which had once contained food for the infant members of the missionaries' families. "So you're not cannibals then?" mocked the chief derisively, pointing to the pictures of babies on the outside of the tins.

These anecdotes do tend to suggest that the function served by pictures when illustrating the contents of retail packages does provide a sound context in which to study the visual properties of individual objects which are widely considered to be the most important to reproduce in accurate pictures of those objects.

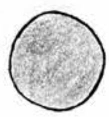
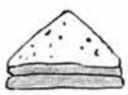
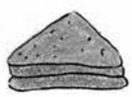
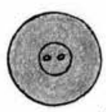
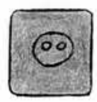
In the studies reported a teddy-bear was cast in the role of a shop keeper. In the teddy's shop were several boxes, each identical and each containing one object which was 'for sale'. One picture could be placed onto each box in order to indicate its contents. This set up provided the context in which the three issues for investigation (cf., above) were examined. In relation to the first issue subjects were asked to make a straightforward choice between an absolute concordant, a colour-only discordant and a shape-only discordant for each object. In relation to the other two issues a substantial modification of the traditional choice-preference procedure was made. Specifically, rather than forcing subjects to choose whether colour-only discordants or shape-only discordants are most acceptable the method adopted was to have the teddy 'choose' either colour-only discordants or shape-only discordants on a systematic basis. Subjects were then given the opportunity to reject the teddy's erroneous choices. As Donaldson and her colleagues have shown (Lloyd, 1975; Donaldson, 1978); young children will readily pretend that a toy figure is capable of independent decision making and will moreover happily correct any errors which they recognise such figures to have made. Consequently when piloting for the present studies revealed that large numbers of children failed to protest at certain of the teddy's erroneous choices it seemed reasonable to suppose that such responses implied acceptance of the teddy's choices and could therefore by legitimately scored as errors. This latter procedure may be said then to be investigating the correspondences which children require whereas the procedure used to test the first issue investigates, by contrast, the correspondences which children prefer.

2.2 Study One: A study of preshool children's judgements of correspondence between objects and pictures of those objects

2.2.1 Introduction

As indicated in the previous section, the present study compared the shape and colour correspondences which young children prefer and require respectively. The two kinds of task each had two sub-conditions; in the first of these the object models were presented physically whilst in the second, the objects were described at the level of the noun phrase but were not seen. Figure 10 reproduces the materials presented on these tasks. On

Figure 10 The critical objects and pictures presented in the correspondence tasks on Study One.

OBJECTS PRESENTED		PICTURES PRESENTED		
appearance	description	shape discordants	colour discordants	'absolute' concordants
	'green ball'	 T.D(1)	 T.C	 T.C
	'triangular sandwich'	 T.C	 T.D	 T.C
	'orange'	 T.D	 T.D	 T.C
	'blue,square button'	 T.C	 T.C	 T.C

(1) N.B. Pictures discordant with regard to a type-defining value (and concordant with regard to a type-modifying value) are marked 'T.D'. Pictures concordant with regard to a type-defining value (but discordant with regard to a type-modifying value) are marked 'T.C'.

both correspondence preference tasks and correspondence requirements tasks, four model objects were presented; these presentations were, as has been noted, either physical or verbal - cf., Figure 10, columns one and two respectively. Each of the four model objects chosen represented one of four kinds of object types. In the case of the green ball (Figure 10, row one), shape but not colour is a type-defining value (the type level being 'ball'). In the case of the triangular sandwich on the other hand (Figure 10, row two), colour but not shape is a type-defining value (the type level being 'sandwich'). The orange (Figure 10, row three) represents a case where both shape and colour are type-defining values (the type level being 'orange'). Finally, the blue square button (Figure 10, row four) represents a case where neither shape nor colour is a type-defining value (the type level being 'button').

Consider the correspondence preference tasks first. On these tasks subjects were given three picture options for each object: one shape discordant, one colour discordant and one absolute correspondent (cf., Figure 10, columns three, four and five, respectively). The present hypothesis is that, independently of whether or not the object models are presented physically or verbally, children will systematically prefer the absolute correspondent for each object presented. If however subjects' correspondence preferences are for something less than absolute correspondence, the present materials permit it to be determined whether these preferences are, although not absolute, nevertheless structured by the systematic avoidance of particular kinds of discordance (ie., pictures discordant with regard to either shape or colour or with regard to type-defining values or type-modifying values respectively).[8]

Consider next the correspondence requirements tasks. In these tasks subjects were required to judge whether either of the two discordant pictures of each object model (cf., Figure 10, columns three and four), separately presented, were satisfactory correspondents. Assuming then that (as piloting had strongly suggested) some of these discordants are judged to be satisfactory, the present materials permit the

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[8] N.B. A more detailed account of these possible outcomes is given in relation to the correspondence requirements task - see next paragraph.

distinction to be made empirically as to whether the shape discordants are rejected more than the colour discordants per se (as a number of literatures - summarised below in the present section - tend to imply) or whether it is rather the case (as may be inferred from the arguments presented in Section 2.1) that rejections tend to occur for pictures which are discordant with respect to type, independently of whether or not pictures are discordant with respect to shape or colour. Specifically with regard to Figure 10 then, what may be termed 'the shape hypothesis' predicts that those discordant pictures accepted will tend to be the colour discordants (column four) rather than the shape discordants (column three). Comparatively, 'the type hypothesis' predicts that the discordant pictures accepted will tend to be those which remain concordant with respect to type (these pictures are coded 'T.C') rather than those which are discordant with regard to type (these pictures are coded 'T.D'). It should be noted at this point that whereas in the case of the ball and the sandwich respectively the type hypothesis clearly indicates that one of the pair of discordant pictures will be much more acceptable than the other (ie., because only one discordant in each case is type-concordant; that is, the colour discordant and the shape discordant respectively) this is not the case for the two remaining models. Thus in the case of the orange, both shape and colour are type-defining values and consequently the type hypothesis predicts that neither the shape nor the colour discordants will be very acceptable whilst, in the case of the button, neither the shape nor the colour dimensional value modified is type-defining and consequently the type hypothesis predicts that both the shape and the colour discordants will be widely accepted.

The present hypotheses (derived from pilot work) were that when the object models were physically presented, preschool children's correspondence requirements would accord with the type hypothesis but that when object models were instead described at the level of the noun phrase, preschoolers would not only reject the type-discordant pictures but would also be much more likely to reject the pictures discordant with regard to type-modifying values. It was therefore hypothesised that children's correspondence requirements will be more absolute when object models are described at the level of the noun phrase than when they are physically presented.

The significance of the present study has previously been indicated but should be summarised at this point. In the first place, it is widely concluded from preschool children's performance on a variety of tasks (including tasks examining correspondence judgements) that young children are very limited in their ability to co-ordinate diverse sources of information (cf., especially, Sections 1.2 and 1.3). This conclusion may however be incorrect and in Chapter One the suggestion was made that young children may perform poorly on these tasks for a number of reasons other than a lack of co-ordinative skill per se. In particular, in considering the choice-preference literature in Section 2.1 it was noted that very little experimental effort has actually been directed to confirming the widely held assumption that young children cannot simultaneously judge shape and colour correspondence correctly. The present correspondence preference tasks examine whether this assumption in the choice-preference literature is a valid one.

It is often concluded from the choice-preference literature that young children are far more likely to attend to shape correspondence than to colour correspondence (cf., Sections 1.3 and 2.1 respectively). The relative importance of shape is also stressed in the literature on language acquisition and in Rosch's criteria for the internal representation of her 'basic level' objects (cf., Section 1.3). One of the possibilities examined by the present correspondence requirements tasks however is whether, when objects are presented physically, young children systematically judge the relative importance of shape and colour correspondence respectively to vary according to the type of object serving as model. The particular significance of this investigation is that if, as hypothesised, the correspondences which children require when object models are physically presented are indeed less than those correspondences which are required when objects are verbally described as well as being less than those correspondences which are preferred but are, nevertheless, based systematically upon type, this would suggest that these correspondence judgements do not arise from involuntary centring upon single dimensions of correspondence but are rather based upon ordered and chosen modes of operating. Such a finding would confirm the suggestion made in Chapter One (Section 1.2 et passim) that children who centre on single dimensions of correspondence are not necessarily behaving unreasonably.

2.2.2 Method

2.2.2 (a) Subjects

Eighty children (40 boys and 40 girls) participated in the study. These children were each in attendance at one of three Edinburgh nursery schools and had a wide variety of social backgrounds.[9] The children's mean age was 4:1[10] and the age range was 2:8 - 5:3.

2.2.2 (b) Materials

2.2.2 (b) i Correspondence preference tasks

The 4 objects and 12 pictures presented on these tasks (both physically and verbally) have already been described in Section 2.2.1 and illustrated in Figure 10 (p.53). It is evident from Figure 10 that most of the pictures presented had some shading to give an indication of the texture of the object surface. These pictures were horizontally mounted with blu-tack in four sets of 3 pictures each (ie.. each picture set comprised the shape discordant, the colour discordant and the absolute concordant for one of the object models) under 4 identical white flaps on a white board.

Each object was presented in one of 4 white cardboard boxes. (Each box measured 7.5cms x 7.5cms x 9.5 cms.) In the verbal presentation condition the boxes were sealed and the description to be used to refer to the contents of each box was written (fairly inconspicuously) on one of the box sides. In the physical presentation condition the boxes were unsealed and unmarked.

The experimental set up was as follows. The E[11] sat opposite each S at a child-sized table which was covered with plain white paper. The teddy was seated in a high chair which was

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[9] N.B. The children participating in each of the child studies reported in this thesis were from a wide variety of social backgrounds.

[10] That is, 4 years and 1 month (not 4.1 years). This method of age notation is used throughout this thesis.

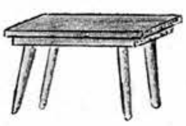
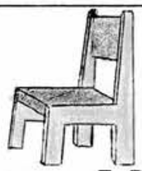
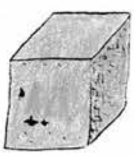
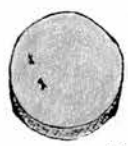
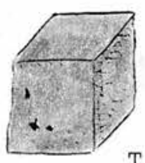
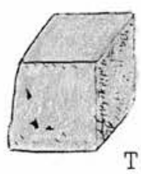
[11] In this thesis, 'E' denotes 'experimenter' and 'S' denotes 'subject'.

positioned next to the E and had a toy cash-register within easy 'reach'. At the outset of the session, the picture board was placed directly in front of the teddy such that the flaps, although facing the teddy, could be reached by the E as well as, ostensibly, by the teddy itself.

2.2.2 (b) ii Correspondence requirements tasks

The 4 critical objects presented in the correspondence preference tasks and illustrated in Figure 10 were also presented for the correspondence requirements tasks. Three further objects were additionally presented on the requirements tasks; these were, a cube of cheese wrapped in cling-film, a toy Christmas tree and a toy brown table. These additional objects were however not critical because for these objects it was determined that the teddy would always 'choose' the absolute concordants; however, the procedure followed still required (cf., Section 2.2.2 (d) i) that, as for the critical objects, shape and colour discordants, respectively, be drawn as well. The non-critical objects and their associated pictures are illustrated in Figure 11.

Figure 11 The distractor objects and pictures presented in the correspondence requirements tasks.

OBJECTS PRESENTED		PICTURES PRESENTED		
appearance	description	shape discordants	colour discordants	'absolute' concordants
	'brown table'	 T.D[1]	 T.C	 T.C
	'cube of cheese'	 T.C	 T.D	 T.C
	'Christmas tree'	 T.D	 T.D	 T.C

[1] N.B. 'T.D' indicates type-discordant; 'T.C' indicates type-concordant.

There were thus 7 objects, 7 boxes and 21 pictures altogether. The pictures were mounted as in the correspondence preference tasks though under seven flaps rather than four.

The experimental set up on the correspondence requirements tasks was as that described for the correspondence preference tasks; however, in the physical presentation condition the objects were initially contained in a plain white bag (cf., Section 2.2.2 (d) i for details of the transfer of the objects to the boxes) and in both presentation conditions the picture board was not shifted from its starting position during the testing session.

2.2.2 (b) iii Knowledge tests

In addition to receiving correspondence requirements and correspondence preference tasks, each S participating in the study additionally received two knowledge tests (details of which are given in Sections 2.2.2 (c) iv and 2.2.2 (d) iii). The first of these tests was a type knowledge test; the only materials used by this test were the 12 pictures of the 4 critical objects (cf., Figure 10) each mounted unsystematically under a separate flap on a new picture board. The second test was a verbal knowledge test which used these same 12 pictures plus the picture board used on the correspondence preference tasks.

2.2.2 (c) Design

2.2.2 (c) i General features

The 80 Ss were divided into two groups of 40 children each; for the subjects in one of these groups the objects were always physically presented whilst for the Ss in the other group the objects were instead verbally described. The allocation of Ss to these groups was constrained by the requirement that the groups be balanced for mean age, age range and sex.[12] The overall design of the study is illustrated in Figure 12. It is evident from this figure that each S participated in two sessions; in the first session a correspondence requirements task was presented and, in the second session, a correspondence preference task followed by the

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[12] N.B. The full details of the characteristics of the various conditions and sub-conditions of this study are given in Appendix A.

Figure 12 Schematic illustration of the experimental design of Study One.

80 Ss

SESSION 1	40 Ss receive physical correspondence requirements task	40 Ss receive verbal correspondence requirements task
SESSION 2	these same Ss receive physical correspondence preference task	these same Ss receive verbal correspondence preference task

all Ss finally receive a type and then a verbal knowledge test

type and verbal knowledge tests respectively were presented. The mean interval between sessions was 18 days (range 10-32 days). The reasons for presenting the tasks in the order they were are discussed in Section 2.2.2 (c) v. What should be noted at this point however is that the reason why all Ss were presented with a correspondence requirements and a correspondence preference task with the same mode of object presentation (ie., physical or verbal) was that such a design made it possible to make within-group comparisons between correspondence requirements and preferences for each presentation mode. Admittedly this feature of the design does have the consequence that the physical and verbal correspondence preference conditions cannot strictly be treated as independent groups (ie., because they have received different earlier treatments); however the within-groups comparisons between correspondence requirements and preferences were considered to be more important (cf., Section 2.2.2 (c) iii).

The following three sections describe the design of the individual tasks.

2.2.2 (c)ii Correspondence requirements tasks

The purpose of these tasks was to determine for each critical object (and for both physical and verbal object presentations), the relative proportion of Ss who reject the shape and colour discordant pictures respectively. In order to achieve this, it was decided that for each of the critical objects, 20 Ss in each of the two groups of 40 Ss (cf., Section 2.2.2 (c) i) would be presented with the shape discordants and that the remaining 40 Ss would be presented with the colour discordants. However, it was further decided that individual Ss should not be offered just shape discordants or just colour discordants. In order to satisfy these conditions, each group of 40 Ss was subdivided into four groups of 10 Ss each (these subgroups were balanced for mean age, age range and sex) and the ten members of each subcondition were then presented with one of four sets of discordant pictures (details of the composition of these sets are given in Appendix A, Table A).

It was noted in Section 2.2.2 (b) ii that, in addition to the four critical objects, three other objects were presented on the correspondence requirements tasks for which the teddy always 'chose' the absolute correspondent. The reason for presenting these additional objects was to ensure that the teddy was seen to select the absolute correspondent for some objects and to thereby avoid the possibility of Ss realising that every picture the teddy chose was likely to be erroneous.

2.2.2 (c) iii Correspondence preference tasks

The intention in presenting the correspondence preference tasks was to discover whether the correspondences which children prefer are more absolute than the correspondences which they require - especially when objects are physically presented but also when objects are described at the level of the noun phrase. Apart from the critical difference as to whether subjects chose or were offered correspondents the procedures followed in the correspondence preference tasks were therefore directly comparable to those followed in the respective correspondence requirements tasks. It should be noted however, that the position of the three pictures of each object (ie., as to whether in the middle or on the left or right relative to the other pictures under the picture board flap) from which Ss selected their choice on the preference tasks (cf., Figure 10) was varied unsystematically. The only other difference between the respective correspondence requirements and preference tasks was that the presentation of distractor objects was omitted on the correspondence preference tasks.

2.2.2 (c) iv Knowledge tests

It is evident that if Ss are to judge correspondence satisfactorily in the verbal presentation conditions, they must necessarily appreciate both the range of type-defining values implicit in each type name and the meaning of any modifiers given. To give an example, a S who has been told that there is 'a triangular sandwich' in a box cannot be expected to reject a picture of a pink triangular sandwich unless he knows that sandwiches are not customarily pink; similarly, this same S cannot be expected to reject a picture of a square sandwich unless he knows that a square is not a triangle. It was therefore decided to make some attempt to assess the extent to which Ss were aware of the particular inadequacies of the discordant pictures presented. Two tests were devised; one to tap type knowledge and one to tap verbal knowledge. It should be noted however that in addition to assessing Ss' knowledge of the type-modifying values, the verbal knowledge test also permitted an assessment of whether Ss possessed the co-ordinative skills required on the verbal correspondence preference task for exclusive identifications of the absolute concordants. Some Ss for example may not be able to identify the 'blue, square button' despite being fully able to understand both 'blue' and 'square' individually. Similarly, some Ss may not be able to identify the 'triangular sandwich' despite being fully aware of the difference between 'square' and 'triangle' and of the fact that sandwiches are never (or at least rarely) pink.

The knowledge (and co-ordination) tests were presented then in order to assist the interpretation of the data obtained on the correspondence tasks. Details of the tests are given in Section 2.2.2 (d) iii. It should be observed here though that Ss who receive physical object presentations do not necessarily require either any type or any verbal knowledge in order to reject picture discordants. Both type and verbal knowledge tests were given to these Ss however for comparative purposes.

2.2.2 (c)v Rationale for the task sequence chosen

It was decided to present Ss with the correspondence requirements and correspondence preference tasks and with the type and verbal knowledge tests respectively in the invariant order they were because it was judged that this sequence would minimise between-task order effects. The reason therefore for presenting the correspondence preference tasks after the correspondence requirements tasks was that it was hypothesised that correspondence preferences would be more absolute than correspondence requirements; specifically, if the preference tasks had been presented before the requirements tasks, Ss might have been more inclined than otherwise to demand the absolute correspondent on the correspondence requirements tasks. The main reason for presenting the type and verbal knowledge tests last was that it was considered desirable (if not essential) in determining the adequacy of Ss' knowledge, to use precisely the same materials as those that were actually used on the main experimental tasks. Given this requirement it seems very likely that if the present type and verbal knowledge tests - which did use the same materials (cf., Sections 2.2.2 (b) iii and 2.2.2 (d) iii) - had been presented before the main tasks, they would have influenced the results gained on these tasks. The reason for invariably presenting Ss with the type knowledge test before the verbal knowledge test was that there was a marked similarity between the correspondence preference tasks and the verbal knowledge test and it was therefore considered to be more satisfactory from the Ss' point of view if these very similar presentations were separated.

2.2.2 (d) Procedures[13]

2.2.2 (d)i Correspondence requirements tasks

All Ss were first introduced to the teddy bear and shown the teddy's cash-register (which was called 'a shopping till'). It was then explained that the reason why the teddy had a shopping till was that he wanted to 'have a little shop'. At this point Ss were presented with the seven objects which, they were told, were the 'things that teddy wants to sell in his shop'. Ss for whom the objects were to be physically presented were given the bag containing them and were encouraged to take them out of the bag one at a time, naming them as they did so. These Ss were then shown the seven boxes and asked to place one object inside each box and to then close the lid

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[13] The procedures given in this section for the correspondence requirements and the correspondence preference tasks are in an annotated format. Verbatim accounts of these procedures are reproduced in Appendix B.

of each box. Those Ss for whom the objects were to be described were merely presented with the boxes, one object being sealed inside each; the contents of each box was then named by the E using the descriptions given in Figures 10 and 11, respectively.

All Ss were next asked to state what was in the boxes and it was demonstrated that in the case of most if not all of the boxes, Ss could not correctly recall the contents. (Ss in the verbal presentation condition generally required little convincing.) Ss were then asked how they thought the teddy might be assisted to remember the contents of each box. Typically, Ss could not, or at least did not, volunteer a suggestion and the E then proposed that just as boxes in shops often have pictures on the outside to show what is inside, so one idea would be to stick a picture on the top of each box in order to illustrate their contents. It was then explained that the teddy possessed a number of pictures and the picture board was repositioned so as to allow Ss to view the three distractor picture sets for a few seconds each. Following this, the suggestion was made that the teddy could perhaps be asked to choose one picture to stick onto each box. The possibility was then raised that the teddy might sometimes choose a picture which failed to show what was inside a box and each child was asked if he would help the teddy by telling him whenever he chose the wrong picture.

The procedure proper then began. Ss in the physical presentation condition were given the first box and asked to name the contents for the teddy so that he (ie., the teddy) could find an appropriate picture. The E then opened the relevant picture flap, pointed to one of the pictures and 'asked' the teddy whether this was the picture he wanted to choose. This process was often repeated for either or both of the remaining pictures (the number of pictures pointed to - one, two or three - was varied unsystematically by the E). The process was only stopped when, ostensibly, the teddy responded affirmatively - the E would lean over to the teddy so that it was plausible that he but not the S could hear the teddy's responses.[14] The predesignated picture (cf., Section 2.2.2 (c)ii)

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[14] Ss could not of course from their position see the pictures at this point - cf., Section 2.2.2 (b)ii - and had, in some cases, to be restrained from shifting their position so as to take personal charge of proceedings.

was then removed from the picture board by the E and proffered to the S. The critical question asked of Ss at this stage was whether they thought the teddy had chosen the right picture or the wrong picture. If a picture was accepted, Ss were permitted to stick it onto the box; if on the other hand a picture was rejected, Ss were asked the grounds of their rejection and the teddy was then requested to choose another picture. Once an errant picture had been rejected, teddy's next picture choice was always the absolute concordant.

For Ss in the verbal presentation condition the E read the verbal label on the box (Ss having been told that the teddy, like them, could not read the words) and the teddy then made 'his' picture choices as in the physical presentation condition.

In both presentation conditions, the first box was always selected by the E and this box always contained the Christmas tree (for which of course, the teddy always chose the absolute concordant - cf., Section 2.2.2 (b)ii). Thereafter the Ss chose which box to illustrate next. When all the boxes had thus been illustrated, Ss were asked to name (with the aid of the pictorial illustrations) the contents of each of the boxes. The order in which Ss were asked to name the box contents corresponded to the order in which the boxes had been illustrated.

2.2.2 (d)ii Correspondence preference tasks

As indicated in Section 2.2.2 (c) iii, the procedures followed in the physical and verbal correspondence preference tasks were very similar to those followed in the physical and verbal correspondence requirements tasks, respectively. Clearly, the main differences in procedure arose because, on the preference tasks, the Ss were required to choose pictures themselves rather than decide upon the adequacy of the teddy's picture choices. To save time however, the objects were always presented in the boxes. Once having named these objects or (in the verbal condition) having had the objects named by the E, Ss were given the picture board. The board was placed on the table with the flaps facing the S. The Ss then chose the object with which they proposed to begin, the appropriate flap was opened by the E and Ss were then asked the critical question -

> " So which picture do you want to choose to show what's inside the box?"

This process was repeated for the three remaining objects.

2.2.2 (d) iii Knowledge tests

When the correspondence preference task had been completed, each S was given the toy cash-register to play with whilst the E prepared the picture board for the type knowledge test (cf., Section 2.2.2 (b) iii). When this had been done the E recovered and removed the cash-register and, having explained that one picture was now hidden under each flap of the new picture board, asked the S to choose one of the pictures. For the first picture chosen, Ss were then asked a question of the form:

> "So what do you think this one is? Can ___ (ie., plural form of the type of object illustrated - or ostensibly illustrated - by the picture eg., 'balls') look like this?"

Ss were then asked to choose each of the remaining pictures in turn; for each of these pictures they were asked:

> "Can ___ (ie., plural form of the appropriate type name) look like this?"

Upon completion of the type knowledge test the E removed the pictures from the type test picture board and repositioned them (unsystematically) into their respective sets on the picture board formerly used on the preference task. These sets were then re-presented to each S in the order in which they had been received in the preference task. Before each picture set was exposed, Ss were asked:

> "Would you show me please the picture of the ____ (ie., description given to the appropriate object in the verbal presentation condition eg., 'green ball')?"

Having made their choice, Ss were then asked for the two remaining pictures in turn:

> "Is this one a ___ (ie., description given to the appropriate object in the verbal presentation condition)?"

If Ss correctly answered each of the three questions asked with regard to any one picture set, they were scored as possessing both adequate verbal knowledge and adequate co-ordinative skill. If however, Ss performed inadequately, they were asked to state the value of the three pictures with regard to the dimension coded by the modifier (eg., "What colour is this?"). To be scored as succeeding on the verbal knowledge test, these Ss were required both to name correctly the type-modifying value of the absolute concordant and type-discordant and to indicate with reasonable accuracy[(15)] the type-modifying value of the modifier-discordant.

2.2.3 Analysis of results

2.2.3 (a) Preliminary remarks

Due to constraints upon space the only results reported below are those which are directly relevant to an assessment of the correspondences which subjects required and preferred respectively. In relation to the statistical tests used, it should be noted that the nature of the allocation of Ss to experimental groups (cf., Appendix A for details) determined that a variety of between-and within-group tests be applied. The use of these tests was governed strictly by the criteria for test use given by Siegel (1956). The main effects evident in the data are discriminable independently of whether or not particular groups of relatively incompetent Ss - identified by the knowledge tests - are excluded from the analyses. The information yielded by the knowledge tests will however be noted where it is suggestive as to how the main effects should be interpreted.

2.2.3 (b) Correspondence requirements tasks

2.2.3 (b)i Physical object presentations

The names which Ss volunteered for the model objects were, overwhelmingly, type-level names (ie., 'ball', 'sandwich' (or 'bread'), 'orange' and 'button', respectively). In only three cases (out of 160) was an object described at any level other than that of type.[(16)]

The first data column in Table 1 indicates the numbers of Ss rejecting each of the discordant pictures offered (out of a maximum possible of 20). The finding that none of the type-concordant pictures (ie., pictures which are discordant with regard to a type-modifying value) are rejected by more than one S each indicates that, as anticipated, neither shape nor colour discordance per se is sufficient to elicit widespread rejections. The findings concerning the type-discordant pictures are however more unexpected. Specifically,

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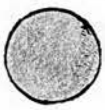
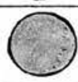
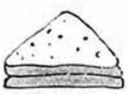
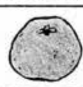
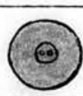
(15) eg., 'square' was adjudged to be sufficiently accurate for diamond and similarly 'red' for pink, etc.

(16) These three cases each occurred in relation to the ball - the names given were 'beachball', 'rubber ball' and 'football' respectively.

whilst both of the shape-type discordants (ie., those pictures which are discordant with regard to both shape and type; that is, the diamond-shaped 'ball' and the triangular-shaped 'orange', respectively) are widely rejected, of the two colour-type discordants (that is, the pink and blue 'sandwich' and the purple 'orange' respectively), only the purple orange is rejected to any extent and, moreover, the number of rejections occurring for the purple 'orange' is not as many as that occurring for the shape-type discordants. Thus, taken as a whole, the results appear to show that whilst there

Table 1 Numbers of children rejecting the discordants on the correspondence requirements tasks and preferring the 'absolute' concordants on the preference tasks, respectively.

Objects Presented	Pictures offered on requirements tasks	A) Nos. of Ss rejecting discordants (requirements tasks)		B) Nos. of Ss preferring absolute concordants (preference tasks)	
		P.O.P. [1]	V.O.P.	P.O.P.	V.O.P.
 'green ball'	 T.D [2]	12	8	17 (0.124) [3]	15 (0.066)
	 T.C	1	8	18 (0.002)	16 (0.008)
 'triangular sandwich'	 T.C	0	7	16 (0.002)	10 (0.454)
	 T.D	1	0	12 (0.002)	6 (0.032)
 'orange'	 T.D	10	10	19 (0.012)	15 (0.344)
	 T.D	5	5	15 (0.002)	17 (0.002)
 'blue square button'	 T.C	1	3	14 (0.002)	10 (0.016)
	 T.C	1	2	10 (0.004)	9 (0.016)

(1) N.B. 'P.O.P.' and 'V.O.P.' - ie., physical and verbal object presentations respectively.

(2) 'T.D' and 'T.C' indicate type-discordant and type-concordant pictures respectively.

(3) Significance levels given in parentheses indicate the degree to which the correspondence preferences of each group of Ss were more absolute than their correspondence requirements (sign test comparisons; two-tailed).

is some variance in the rejection rates for each picture which can be systematised in terms of the types of the object referents, these effects do not appear to be thoroughly independent of shape and colour correspondence respectively. Statistical analyses confirm this conclusion. One method of analysing the data is to compare the numbers of rejections for the shape-and colour-discordants respectively of each object model. Such an analysis indicates that the red ball is accepted significantly more than the diamond-shaped 'ball' (applying χ^2, $p < 0.001$[17]) but that the purple 'orange' is not accepted significantly more than the triangular shaped 'orange' (applying χ^2, $p < 0.2$ only). Thus whereas a shape-type discordant (ie., the diamond-shaped ball) is rejected significantly more than a colour discordant (the red ball), a shape-type discordant (the triangular orange) is not rejected significantly more than a colour-type discordant (the purple orange). This result does (by implication) lend some statistical weight to the view that children are more inclined to reject colour-type discordants than colour-discordants per se (just as they are, without doubt, more inclined to reject shape-type discordants than to reject shape-discordants per se).[18] There is however a second, more direct means of making such comparisons and, most importantly, the outcome of this second set of comparisons does not point to the conclusion which the first set does. Specifically, this second analysis involves comparing the rejection rates for the three stimuli which are fairly widely rejected (ie., the diamond-shaped 'ball', the triangular-shaped 'orange' and the purple 'orange') with the rejection rates obtained for those pictures which are discordant with regard to the same dimension but which are not type-discordants. Thus, Ss rejected the diamond-shaped 'ball' significantly more than the square sandwich and significantly more than the round button (applying, for

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[17] All applications of χ^2 reported in this thesis for frequency data in 2 x 2 contingency tables employed the continuity correction given by Siegel (1956). All p-values given in this thesis are for two-tailed tests unless indicated otherwise.

[18] Nevertheless, when the data for the two orange discordants obtained in both the physical object presentation and the verbal object presentation are combined (ie., to produce a total of 40 Ss receiving each discordant) the number of rejections for the triangular 'orange' is found to be significantly more than that occurring for the purple orange (applying χ^2, $p < 0.05$).

both comparisons, Fisher's method[19] for sign test plus Fisher's exact probability test, $p < 0.01$ - in each case). Similarly, Ss rejected the triangular 'orange' significantly more than both the square sandwich and the round button (applying, for both comparisons, Fisher's method for sign test plus Fisher's exact probability test, $p < 0.02$ and $p > 0.05$ just, respectively). However, the purple orange was not rejected significantly more than either the red ball (applying χ^2, $p < 0.5$) or the orange button (applying Fisher's method for sign test plus Fisher's exact probability test, $p < 0.7$).

It is apparent that this second set of comparisons indicates that whilst shape-type discordants were rejected significantly more than shape-discordants per se, colour-type discordants were not rejected significantly more than colour-discordants per se. One important question which arises is whether there is any evidence that the greater number of rejections which occurred for the shape-type discordants relative to the colour-type discordants is in some way attributable to the children having differing knowledge of these two kinds of object type. In this regard, Table 2 presents some revealing information concerning the children's performance on the type knowledge test. This table shows that although the great

Table 2 The proportion of children making errant judgements about the type of each discordant picture presented.

A. Ss judging type-concordants as type-discordants.			B. Ss judging type-discordants as type-concordants.		
Stimulus	Nos.	Percents.	Stimulus	Nos.	Percents.
red ball	2 (5)	5 (12.5)[1]	diamond-shaped 'ball'	7 (8)	17.5 (20)
square sandwich	2 (0)	5 (0)	pink and blue 'sandwich'	21 (20)	52.5 (50)
round button	2 (2)	5 (5)	triangular 'orange'	14 (12)	35 (30)
orange button	3 (5)	7.5 (12.5)	purple 'orange'	22 (16)	55 (40)

[1] For each data column the unbracketed numbers indicate the numbers (or percentages) of pertinent Ss in the physical presentation condition. The bracketed numbers indicate the corresponding Ss in the verbal presentation condition and are included for comparative purposes - cf., Section 2.2.3 (c).

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(19) N.B. It is evident from a consideration of Appendix A (see, especially, Table B) that the majority of this second set of comparisons require that, if all the relevant data are to be used, then data obtained from both within-and between-subject groups must be combined. The statistical procedure used to do this was Fisher's method. A detailed account of this procedure is given by Kendall and Stuart (1976). A worked example is included in Appendix A.

majority of Ss accurately identified the type-concordants as type-concordants (Section A), a surprisingly high proportion of Ss failed to recognise the type-discordants to be type-discordant (Section B). In particular, more errors were made for each of the two colour-type discordants than were made for either of the two shape-type discordants.[20] The relative ignorance of Ss as to the type status of colour-type discordants relative to shape-type discordants may then to some extent explain why the rejection rate was lower for colour-type discordants than for shape-type discordants on the correspondence requirements tasks. Nevertheless however, this type knowledge data does not account for why those Ss who were knowledgeable about the type status of the colour-type discordants failed to reject them. The number of cases in this category is considerably larger for the pink and blue 'sandwich' than for the purple 'orange'. Thus, whereas in the case of the purple orange, 5 of the 9 children presented with the stimulus who were type knowledgeable, rejected it; in the case of the pink and blue 'sandwich', only 1 child out of the 8 children who were type knowledgeable rejected it. Some light is shed on the answer to this question by the results presented in Table 3. This table reports the numbers of Ss who performed adequately on the type and verbal knowledge tests (data column one); the percentage of these Ss who accepted either of the discordants on the co-ordination component of the verbal knowledge task (data column two) and the percentage of these latter Ss who accepted the colour-discordants (data column three). What is most striking in this table is that a very much larger proportion of Ss accepted either (or both) of the discordants occurring in the sandwich set (cf., data column two) than accepted either (or both) of the discordants occurring in any of the other sets. Moreover, of the very large majority of Ss who did accept sandwich discordants, each S failed to reject the pink

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(20) Specifically, combining the data for physical and verbal presentation conditions, the type-errancy of the diamond-shaped 'ball' was better known than that of the pink and blue 'sandwich' and the purple 'orange' respectively (applying sign test, p=0.002 in both cases) but was not comparably better known than that of the triangular 'orange' (sign test, p=0.078); similarly the type-errancy of the triangular 'orange' was better known than that of the pink and blue 'sandwich' and the purple 'orange' (applying sign test, p=0.002 and 0.05, respectively).

Table 3 Breakdown of the erroneous acceptances of discordants on the co-ordination task by children who succeeded on the type and verbal knowledge tests.

Stimulus Set	No. of Knowledgeable Ss	Percent. of knowledgeable Ss accepting either of set discordants	Percent. of Ss accepting discordants who accept colour discordants
Ball	27 (21) (1)	26 (19)	29 (0)
Sandwich	15 (16)	93 (81)	100 (100)
Orange	15 (21)	27 (24)	50 (80)
Button	25 (17)	36 (24)	67 (50)

(1) N.B. For each data column the unbracketed numbers indicate the numbers (or percentages) of Ss in the physical presentation condition. The bracketed numbers indicate the corresponding Ss in the verbal presentation condition and are included for comparative purposes - cf., Section 2.2.3 (b) ii.

and blue 'sandwich' (cf., data column three). This effect is considerably less marked in the case of the purple 'orange' discordant.

The findings identified in relation to the sandwich stimulus set in Table 3 may, to some extent, reflect simply a general inclination on the part of young children to accept on the co-ordination task, type-discordants which are concordant with regard to a single articulated modifier more than type-concordants which are discordant with regard to a single articulated modifier; thus this effect is evident similarly in relation to the ball stimulus set (cf., Table 3; data column three). Nevertheless the strength of the effect occurring with regard to the sandwich set relative to that occurring for the ball set does suggest that Ss found it especially difficult to reject the pink and blue sandwich.

The question as to how these and the other findings reported should be interpreted will be considered in Sections 2.2.4 and 2.3.3.

2.2.3. (b) ii Verbal object presentations

Consider next the picture discordants which Ss rejected when objects were described at the level of the noun phrase rather than presented physically (cf., Table 1; section A). It is evident that the Ss who received the verbal presentations rejected the type-discordants in comparable numbers to the Ss who received the physical presentations but also, in addition, rejected the pictures discordant with regard to the type-modifying values to a greater extent. The latter effect is only a pronounced one however for the red ball and square sandwich picture stimuli respectively. Thus the red ball was rejected significantly more when the model object was presented verbally than when the model was presented physically (applying Fisher's exact probability test, $p = 0.0196$). The comparable comparison for the square sandwich is also significant (applying Fisher's exact probability test, $p = 0.0083$); none however of the other discordants elicited significantly different rejection rates between physical and verbal object presentations. No modifier effects were possible of course with regard to the orange model (for which no modifiers were given); what was unexpected however was that no significant modifier effects were observed in relation to the two button discordants. It may well be significant in this regard that whereas, in the case of the ball and sandwich models, a single modifier was given in each verbal presentation, in the case of the button model, two modifiers were given in the verbal presentations and the picture discordants were only discordant with regard to one of these modifiers. Certainly, the impotency of the modifiers given in relation to the button stimuli cannot be readily understood in terms either of Ss being markedly less knowledgeable as to the deviancy of the button discordants or less able to co-ordinate this knowledge than they were for the other modifier discordants (some indication of this is given in Table 3; data columns one and two, respectively).

2.2.3 (c) Correspondence preference tasks

Table 1, Section B (p.68) shows the number of Ss receiving each discordant on the correspondence requirements tasks who chose the absolute correspondents on the correspondence preference tasks. It is evident from the probability values plotted in data column three that, for those Ss for whom the objects were physically presented, only one comparison - that for the diamond-shaped 'ball' - fails to indicate that Ss were more likely to prefer the absolute correspondent than they were to require it. The reason why the comparison for the diamond-shaped 'ball' is insignificant appears to be that there is something of a ceiling effect for this stimulus.

By contrast, the comparable comparisons for those Ss for whom the model objects were verbally described (cf., Table 1; data column four) attain statistical significance less frequently. One important reason for this is probably that there are more ceiling effects (cf., the diamond-shaped 'ball' and the triangular 'orange', respectively). It is evident however that on the sandwich and button sets, Ss are not responding at ceiling levels of performance. It should be noted too in relation to these performances that there is a possibility that some Ss may have selected the absolute correspondents on the preference tasks as a consequence of chance responding rather than specific preference.

At this point a consideration of the non-absolute correspondence preferences which Ss made is illuminating. It is evident from Table 4 that, with the exception of the button stimulus set, the non-absolute choices made tend, overwhelmingly, to be for the colour-discordants. In the case of the colour-type discordants this trend may be due in

Table 4 Numerical breakdown of non-absolute preferences as a function of discordants received on correspondence requirements tasks.

Stimulus Set	Discordant received on requirements task	Visual Object Presentation		Verbal Object Presentation	
		Ss choosing colour discordant	Ss choosing shape discordant	Ss choosing colour discordant	Ss choosing shape discordant
Ball	diamond 'ball'	3	0	4	1
	red ball	2	0	4	0
Sandwich	square sandwich	4	0	9	1
	pink and blue 'sandwich'	8	0	13	1
Orange	triangular 'orange'	1	0	5	0
	purple 'orange'	3	2	3	0
Button	round button	0	6	2	8
	orange button	8	2	6	5

part to a marked lack of knowledge of the type deviancy of these stimuli (cf., Table 2). In the case of the sandwich stimulus set however there also appears to be a weak memorial effect operative whereby Ss are more likely to select the colour-type discordant if they were offered this stimulus on the correspondence requirements task. A similar memorial effect is also evident in the case of the button stimulus set.

2.2.4 Discussion of implications and formulation of some further questions

Study One raises a number of important questions which formed the basis of a follow-up study. Because these first two studies are genuinely sequential, only the immediate questions raised by Study One will be discussed in the present section. The results of both studies will then be considered together in a joint discussion (cf., Section 2.3.3).

The present study found that when suitable objects were described by a type name plus a single modifier, preschool children were more likely to require correspondence with regard to the type-modifying values than when objects were physically presented. It also found that the correspondences which the children preferred did tend, especially when objects were physically presented, to be more absolute than the correspondences which were required. The most fundamental question raised by Study One concerns how the results obtained for the physical presentation condition of the correspondence requirements task should be interpreted. Specifically, it was found that whilst the discordants which the children in this condition rejected tended, overwhelmingly, to be those which were discordant with regard to a type-defining value, it was not the case that all such discordants were rejected. In particular, it was found that whilst the two shape-type discordants were widely rejected, the two colour-type discordants were not so widely rejected and indeed, for one of these stimuli (the pink and blue 'sandwich') the rejection rate was negligible. There are several possible explanations for this result. The first of these is that the result should be regarded as confirmation of the traditional view (cf., Section 2.2.1) that young children do, for all kinds of object, attend more to shape than to colour. The adoption of this view does not necessarily require an explanation for the finding that the purple orange stimulus was quite often rejected (ie., because it was rejected less than were shape-type discordants); however, it could be argued in this regard that rejections occurred for the purple orange not because it was a type-discordant stimulus but rather because the type name 'orange' - corresponding as it does to the appropriate colour modifier for this object - tended, in some cases, to function as a modifier rather than as a type name per se.

The main objection to a traditional interpretation of the correspondence requirements which subjects made when objects were physically presented is that subjects quite happily accepted shape-discordants so long as they were not type-discordants. There are however at least two alternative explanations for this result. Both these explanations focus attention upon the nature of the type-discordant stimuli which were presented. The first possibility is that children may require, independently of shape or colour correspondence per se, only that picture correspondents should accord with regard to dimensional values which are <u>invariant</u> between type members. This suggestion arises from the consideration that whereas balls are always (or nearly always[21]) round and oranges are both always more or less round and always coloured orange, sandwiches can be made with bread of a considerable variety of brown and white tones and the fillings (if not the bread itself[22]) may moreover (eg., in the case of open sandwiches) be very variously coloured. One possibility which arises from these considerations then is that young children will tolerate discordants with regard to type-defining values which in everyday life exhibit a range of values. In this view then, the purple 'orange' would be expected to elicit more rejections than the pink and blue 'sandwich'. There is however an alternative possibility. This alternative is that young children may require only that pictures of physically presented objects should not be misleading with regard to the type of the model; that is, it may be that a picture such as the pink and blue 'sandwich' is accepted on the basis that it <u>cannot really be portraying anything else</u>; anything other, that is, than a sandwich. In considering the likelihood of this view being correct it should be noted that it does seem reasonable to suggest that the diamond-shaped 'ball', the

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(21) It seems reasonable to suppose that preschool children are not familiar with rugger balls.

(22) Bread can of course be coloured artificially but again preschool children seem unlikely to be aware of this.

triangular 'orange' and to a lesser extent, the purple 'orange' are rather more misleading as to the type of their respective models than is the pink and blue 'sandwich'; consequently the present suggestion is consistent with the number of rejections made for each of these stimuli on the physical correspondence requirements task in Study One.

The first issue investigated in Study Two then, concerned which of these three possible interpretations of young children's correspondence requirements for physically presented objects, seems most likely to be correct. The second question examined in Study Two is closely related to the first question. Specifically the second question concerns whether young children accept or reject a picture which corresponds to a physically presented model on neither shape nor colour but yet portrays an object of the same type. It is evident that both of the two type-based explanations (outlined immediately above) of the children's correspondence requirements in Study One do predict that young children will accept such 'correspondents'.

The third question examined is whether the type-discordants rejected in the physical presentation condition in Study One were only rejected as a consequence of subjects having been required to name the model objects - a naming process which (as was noted in Section 2.2.3 (b) i) almost universally elicited an appropriate type name. This investigation then is concerned with whether or not the rejection of type-discordants under these conditions is dependent upon overt type-naming.

The fourth (and the final) question examined concerns whether young children's correspondence requirements are more absolute in the verbal presentation condition because of the presence of the modifier merely or both because of the presence of the modifier and the absence of the physical presentation of the object. This latter alternative is not so unreasonable as might first appear. If it is the case, as Aristotle observed all those years ago, that we do see in the particular kinds of thing, general qualities rather than uniqueness, then it may be that viewing objects directly actually inhibits children (and adults) from attending the type-modifying values. In this view, the more absolute correspondence requirements gained in the verbal presentation condition may stem as much from the absence of this visual set as from the presence of the modifiers.

2.3 Study Two: A further study of the correspondences which preschool children require between objects and pictures of those objects

2.3.1 Method

2.3.1 (a) Subjects

One hundred and twenty children (61 boys and 59 girls) of mean age 3:9 years (range 3:0 - 4:7 years) took part in the study. All these children were in attendance at one of three nursery schools or nursery classes in Edinburgh.

2.3.1 (b) Materials

The experimental set up used in the study was precisely the same as that which was employed in the correspondence requirements tasks on Study One; the materials used - excepting the critical objects and pictures presented - were also as those described for the first study (cf., Section 2.2.2 (b) ii). The critical objects and pictures used in the present study are illustrated in Table 5 (p.86). The first four objects featured in this table were each models of real-life objects; these objects comprised a yellow knife taken from a toy cutlery set, a brown horse in a standing posture, a red teapot and a giraffe - also in a standing position. The fifth critical object was a blue spherical candle with a white wick. The rationale behind the selection of these objects (and pictures) is explained in the next section (cf., 2.3.1 (c)).

In addition to the five critical objects, one distractor object was presented to each S. This object was the toy Christmas tree used as a distractor object on Study One; the pictures used of this object were also the same as those used in the previous study (cf., Figure 11). Altogether therefore, 6 objects, 6 boxes and 19 pictures[(23)] were used in the present study.

2.3.1 (c) Design

2.3.1 (c) i General features

A schematic representation of the design of the study is shown in Figure 13. The 120 Ss were divided into three groups of 40 children each. For Ss in the first condition the objects were physically presented but the E did not name them nor were the Ss

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(23) N.B. The absolute-concordants are not illustrated in Table 5.

asked to do so; in the second condition Ss were also shown the objects but in addition the E named each object with the appropriate type name - these type names are indicated in the first column of Table 5 (cf., p. 86, - the type names are unbracketed); finally, Ss in the third condition were also shown the objects but the E named each object at the level of the noun phrase. (These labels corresponded to the full descriptions indicated in the first column of Table 5.) The allocation of Ss to these three conditions was constrained by the stipulation that the conditions be balanced with regard to mean age, age range and sex.[24]

Figure 13 Schematic illustration of the experimental design of Study Two.

120 Ss

40 Ss receive correspondence requirements task in which they are merely shown each object. (This presentation condition will be abbreviated 'P'.)

40 Ss receive correspondence requirements task in which, for each object, they are both shown it and given the appropriate type name. (Presentation condition 'P-T'.)

40 Ss receive correspondence requirements task in which, for each object, they are both shown it and given the appropriate type name plus relevant modifier(s) (Presentation condition 'P-T-M'.)

Finally, each S receives, in the same experimental session, a verbal and then a type knowledge test.

It is evident from Figure 13 that, immediately following the appropriate correspondence requirements task, each S was presented with a type and then a verbal knowledge test.

2.3.1 (c) ii Manner of investigating the questions to be examined

The study was designed to tackle the four issues raised above (cf., Section 2.2.4) in the following manner.

1. Question One: What is the basis of preschool children's correspondence requirements when object models are physically presented?

This question was concerned with how the findings of Study One

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[24] N.B. Full details of the characteristics of the various conditions and sub-conditions of this study are given in Appendix C.

with regard to the rejection of the type-discordants on the physical correspondence requirement task should be interpreted. Three possibilities have been previously identified (cf., Section 2.2.4). Specifically, it may be the case that young children reject type-discordants which are discordant with regard to dimensions that are invariant between type members but accept type-discordants which are discordant with regard to a dimensional value which shows any variation between type members; alternatively, it may be that young children reject type-discordants which are misleading with regard to the portrayal of type but accept type-discordants which nevertheless convey the correct type unambiguously. The third possibility is that young children may simply tend to reject shape-type discordants but accept colour-type discordants.

The condition in the present study which was primarily designed to investigate this question was the condition in which children were shown the objects and given the type names.(25) Children's responses to four of the eleven pictures illustrated in Table 5 (p.86) were critical in relation to this question. Of these four pictures, two pictures are colour-type discordant with regard to their respective object models (ie., the zebra and the blue giraffe) and two pictures are shape-type discordants (ie., the spoon and the teapot with a spoon bowl inserted where the spout would normally be). In each of these picture pairs, one picture (the teapot-spoon and the blue giraffe, respectively) was considered to be discordant with respect to an invariant property but nevertheless not misleading with regard to type whilst the other picture (ie., the spoon and the zebra, respectively) was judged to be discordant in respect of a dimension with a restricted range of values between type members but to be, in-spite of this, misleading as to type.

The assumptions and rationales underlying the selection of these materials should next be outlined. Consider first the pair of colour-type discordants. The assumption made was that horses evidence a limited variation in colouring whereas giraffes exhibit virtually no

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(25) That is, this condition effectively corresponds to the physical presentation condition in Study One; because, in Study One, Ss almost universally named every object at the type level.

variation in their colouring. In addition it was assumed that whereas the picture of a zebra would be misleading as to the type of the model horse (ie., because it differs in type from the model), the picture of a blue giraffe is not misleading as to the type of the model giraffe (ie., because since giraffes have such a distinctive shape, the picture of a blue giraffe could not be identified as anything other than a picture of a giraffe). The rationale then was that if it is the case that children require that pictures should correspond only on dimensions which are invariant between type members, then the zebra should be accepted and the blue giraffe rejected. Alternatively, if it is the case that children require only that a picture should not be misleading with regard to type, then the zebra should be rejected and the giraffe accepted. If instead, it emerges that neither of the colour-type discordants are widely rejected then this would tend to support the traditionalist view that young children do not pay very much attention to colour correspondence under any circumstances.

Consider next the pair of shape-type discordants. In the course of deciding upon the objects and pictures to be used for these comparisons it had become clear that any shape-type discordance between object and picture which is produced by changing the shape of the picture completely makes that picture thoroughly misleading as to type. Since, by contrast, many, many pictured objects will remain non-misleading as to type if only the colour of the object represented is made type-discordant, it becomes evident that shape discordances, far more often than colour discordances, will involve a change in the identity status of a picture. Having recognised this 'eternal truth' it becomes clear that it is not possible to have shape-type discordants which directly parallel the colour-type discordants chosen. If then it transpires that Ss do appear to require only that a picture should be non-misleading as to type it seems only reasonable to suppose that children will, of necessity, be predisposed to make more requirements for shape correspondence than for colour correspondence for most kinds of object.

It has been noted above however that a shape-type discordant was used in the present study which was judged to be non-misleading as to type. As previously indicated this discordant is the teapot-spoon picture. The choice of this picture was based upon the thinking that only such an unobtrusive discordant would be likely to leave a shape-type discordant picture non-misleading as to type. It is evident that the teapot-spoon picture is not completely but only <u>partially</u> discordant with regard to the shape of its respective model. This feature of partial shape discordance only is also a characteristic of the shape-type discordant picture which is misleading as to the type of its model (that is, the picture of the spoon and the model knife). It was assumed in relation to these stimuli that different knives are more variant in respect of their shape than teapots are. The rationale then was that if young children do require only that a picture should be non-misleading with regard to type, then <u>S</u>s should reject the spoon but accept the teapot-spoon. This result would indicate that some shape-type discordance <u>is</u> tolerated by <u>S</u>s (there would, of course, if such a result were gained, be no doubt that, were complete shape-type discordants to be offered as pictures of shape-type objects, such pictures would always be rejected by children knowledgeable as to type). A second result which is possible with these materials is that both shape-type discordants may be rejected. Such a finding would probably indicate (depending upon the children's responses to the colour-type discordants) that there is a shape bias whereby, for shape but not for colour, young children reject pictures which, though discordant, are not misleading as to type. The third and (on the basis of the piloting which was conducted) the least likely result is that <u>S</u>s may accept the spoon and reject the teapot-spoon. If such a finding were to be obtained this would suggest that young children require that pictures should accord completely with regard to shape when shape is invariant between type members (ie., because <u>S</u>s reject the teapot-spoon) but that they do not require complete shape correspondence when the precise shape varies between type members (ie., because <u>S</u>s accept the spoon).

2. Question Two: What correspondences are required in pictures of objects for which neither shape nor colour is a type-defining value?

This question has particular relevance for the physical presentation condition in Study One (cf., Section 2.2.4) and therefore the critical presentation condition is again the P-T(26)

(26) N.B. This abbreviation has been explained in Figure 13 (p.79).

condition. The primary focus of the present question constitutes then a particular case of question one. A single object was chosen for the examination of this question; this was a blue, spherical candle with a white wick (cf., Table 5). The method followed was to offer 20 Ss in each condition the picture of the purple, narrow tapered candle and to offer 10 Ss in each condition the picture of the purple round candle and the remaining 10 Ss in each condition the picture of the blue narrow tapered candle. This permits the rejection rate for the shape- and colour-discordant picture to be compared with a base-line rejection level established jointly by shape- and colour-only discordants (cf., Appendix C for details of the groups).

3. Question Three: Is the rejection of type-discordants dependent upon the overt naming of object types?

This issue was investigated by comparing children's performance when model objects are simply physically presented (ie., condition P) with that arising when the objects are both physically presented and also described with an appropriate type name (ie., condition P-T). If it is the case that type effects are contingent upon explicit mention of the type name then the rate of rejection of type-discordants in condition P-T should be more marked than that in condition P; if, on the other hand, overt type naming is irrelevant, the results elicited by these two conditions should be indistinguishable.

4. Question Four: Are the effects of modifiers on correspondence requirements dependent upon the absence of physical object presentations?

This question was investigated by comparing children's correspondence requirements when they are both shown the objects and given a description of the objects at the level of the noun phrase (ie., condition P-T-M) with those requirements made when children are shown the objects but given only type names (ie., condition P-T). If it is the case that the giving of modifiers is alone sufficient to make correspondence requirements more absolute than otherwise then the correspondence requirements made by Ss in condition P-T-M should be more absolute than those made by Ss in condition P-T. Alternatively, if the absence of a physical object presentation is necessary for the modifiers to exert an effect then the correspondence requirements made in the two conditions will not differ.

2.3.1 (c) iii Further design features

The design aspects of the present correspondence requirements tasks and knowledge tests were very similar to those of the corresponding tasks used in Study One. However one difference was that there was only a single distractor item in the present correspondence requirements task. The sessions in Study Two were always begun though with the presentation of the distractor.

With regard to the pictures offered to individual Ss on the present correspondence requirements task, the 40 Ss in each of the three presentation conditions were subdivided into two groups of 20 Ss each. These groups were each presented with a different set of four discordant pictures (each set comprising two colour discordants and two shape discordants) plus one of the discordant candle pictures. As has already been indicated (cf., previous section), a further sub-division was made to one of the groups of 20 Ss in each presentation condition for the purposes of the candle presentations. Details of the composition of the picture sets which Ss received are given in Appendix C.

Each of the S groups was balanced for mean age, age range, sex and nursery (or nursery class); see Appendix C for details.

2.3.1 (d) Procedures

The correspondence requirements task procedures followed in the present study were virtually identical to the procedures followed in the physical requirements task in Study One. The only modifications concerned the critical differences arising from whether, and if so how, the objects were named. In the two conditions in which the objects were named, each object was named at the same points as in Study One (ie., when objects were taken out of the bag and when the child selected objects for the teddy to 'choose' the pictures). In the remaining presentation condition Ss were neither asked for nor given any object names; and at the point when the teddy was asked to choose the pictures, Ss were merely asked to show the objects to the teddy.

The procedure followed for the verbal knowledge test (including the co-ordination component) was identical to that used in Study One. In the case of the type knowledge test however the critical question was altered to:-

"Can real_____(ie., pleural form of type name, eg., 'balls') look like this?"

In addition, before the critical questions were asked, Ss were asked the following rhetorical questions:-

"Now some of the pictures are just pretend pictures aren't they? You might see pictures like them but you never see real things like them do you?"

These changes were made because it was suspected that some Ss may have indulged in fantasies on this test in Study One and because it was considered that the alterations might reduce the likelihood of such fantasies occurring.

2.3.2 Analysis of results

2.3.2 (a) Preliminary remarks

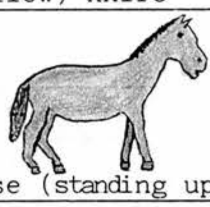
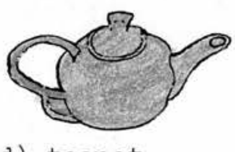
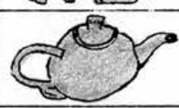
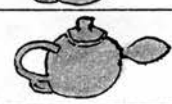
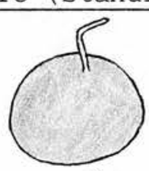
The analyses reported are confined to those which are directly relevant to the four questions identified in Section 2.2.4. The presentation of these analyses will be structured in terms of the relevant object presentation conditions. As was the case in Study One (cf., Section 2.2.3 (a)) the main effects are fairly clear, independently of whether or not particular groups of relatively incompetent Ss are omitted from the analyses; some consideration will however be given to the knowledge test data where it is illuminating.

2.3.2 (b) Performance of children in the P-T presentation condition

2.3.2 (b) i Question 1: Correspondence requirements for the knife, horse, teapot and giraffe models

It is evident from Table 5 (data column two) that only two pictures (both type-discordants) are widely rejected (ie., the yellow spoon when offered as a picture of the yellow knife and the zebra in a standing posture when offered as a picture of a horse in a standing position). The rejection rates occurring for each of these two pictures are significantly greater than those for the respective pictures offered of the same object and also significantly greater than those for each of the pictures that are discordant with regard to the same dimension but are not discordant with regard to type. Thus, the yellow spoon is rejected more than the pink knife (applying χ^2, $p \angle 0.05$) and also more than the teapot-spoon (applying χ^2, $p \angle 0.01$), the kneeling giraffe (χ^2, $p \angle 0.02$; $\searrow 0.01$ just) and the horse lying down (sign test, $p = 0.002$).[27] Similarly, the zebra is rejected more than the horse lying down (χ^2, $p < 0.001$) and also more than the blue giraffe (χ^2, $p < 0.05$; > 0.02 just), the green teapot (χ^2, $p < 0.01$) and, less significantly, the pink knife (sign test, $p = 0.07$).[28]

Table 5 Numbers of children rejecting the picture discordants in each object presentation condition.[1]

Objects presented	Pictures offered	Object presentation conditions P	P-T	P-T-M
		0	5	5
(yellow) knife		18	13	11
		15	11	17
horse (standing up)		2	0	7
		1	2	6
(red) teapot		2	3	2
		2	3	1
giraffe (standing up)		0	4	4
	 ¦ 	0 ¦ 0	0 ¦ 3	1 ¦ 2
(blue,round) candle		3	3	5

(1) There were three presentation conditions. In the first (abbreviated 'P'), Ss were merely shown the objects. In the second (abbreviated 'P-T'), Ss were shown the objects and given the type name (ie., the unbracketed name in column one). In the third (abbreviated 'P-T-M'), Ss were shown the objects and given the type name plus one or two relevant modifiers (these modifiers are bracketed in column one). There are thirty main data cells in the table. In each of these cells (ie., those with a continuous border-line) the maximum number of possible rejections is twenty. The maximum number of possible rejections in each of the six sub-cells (ie., cells with a partially discontinuous border-line) is ten.

(27) N.B. The nature of the allocation of Ss to experimental groups (cf., Appendix C) necessitates the use of both between-and within-group tests.

(28) A reason is suggested in Section 2.3.2 (c) as to why a relatively high number of rejections occurred for the pink knife.

The finding that the only pictures to be widely rejected were the spoon and the zebra suggests (cf., Section 2.3.1 (c) ii) that, independently of shape or colour correspondence per se, Ss tend to reject only the type-discordants which portray the type of the model misleadingly. In particular it is noteworthy that the rejection rates for the remaining two type-discordants (ie., the teapot-spoon and the blue giraffe) are markedly low. Interesting confirmation of the acceptability of the latter two type-discordants relative to the spoon and zebra discordants is provided by the performance on the co-ordination component of the verbal knowledge task of those children who are fully knowledgeable as to the type-discordance of each type-discordant. Table 6 presents this data.

Table 6 Proportion of type-knowledgeable children who rejected each type-discordant on the co-ordination task.[1]

Type discordants offered	No. of type-knowledgeable Ss	Type-knowledgeable Ss rejecting discordants	
		Nos.	Percents.
Spoon	17	17	100
Zebra	11	11	100
Teapot-Spoon	8	1	12.5
Blue-Giraffe	14	1	7.1

[1] Data shown are for those Ss presented with each discordant on the requirements task in condition P-T (the performance of other Ss was virtually identical). In the case of the teapot-spoon stimulus the number of Ss who are type-knowledgeable (cf., data column one) is rather small.

2.3.2 (b) ii Question 2: Correspondence requirements for the candle model

Table 5 (data column two; bottom row) presents the pertinent data. It is evident that the number of rejections occurring for the picture discordant with regard to both shape and colour was the same as that elicited by the base-line condition - which comprised an equal number of presentations of the colour-only discordant and the shape-only discordant. Moreover these rejection rates are very low.

When the number of rejections occurring for the candle discordant with regard both to colour and shape is compared with that for each of the other discordants presented it is found that the candle stimulus is not significantly rejected any more or less than any of the stimuli with the exception of those two discordants which are misleading as to the type of their respective models - that is, the spoon (sign test, p = 0.008) and the zebra (χ^2, $p < 0.05$; $p > 0.02$ just).

2.3.2 (c) Question 3: Relative performance of children in the P and P-T presentation conditions

It is apparent from data columns one and two of Table 5 that the pattern of responding in the P and P-T object presentation conditions is generally very similar. Indeed, when the number of rejections occurring for each picture discordant in the two conditions is compared, only one of these comparisons attains a two-tailed significance level of 0.05 or better; this significant result occurs for the pink knife (Fisher's exact probability test, p = 0.047).[29] That this comparison attains significance however may merely be a spurious consequence of having made ten comparisons with a null hypothesis in each case. There is however some evidence in the data of a trend whereby pictures discordant with regard to type-modifying values are generally more likely to be rejected in condition P-T than in condition P.

2.3.2 (d) Question 4: Relative performance of children in the P-T (and P) and P-T-M presentation conditions

It is evident from Table 5 that there is a tendency for the pictures which are discordant with regard to type-modifying values to be rejected more in the P-T-M presentation condition than in the P-T and P conditions, respectively. These effects are not however widespread; specifically, no type-modifying value discordant is rejected significantly more in the P-T-M condition than in <u>both</u> the P and P-T presentation conditions respectively. There are only two instances of significant differences; the pink knife is rejected more in the P-T-M condition than in the P condition (Fisher's exact probability test, p = 0.047) and the horse lying down is rejected more in the P-T-M condition than in the P-T condition (Fisher's exact probability test, p = 0.008). This pattern of results is

[29] N.B. Applying Fisher's exact probability test, the comparable comparison for the kneeling giraffe picture yields a p-value of only 0.106.

little changed when those Ss who were found on the verbal knowledge test to be unfamiliar with the meaning of the modifiers given are excluded from the analyses. As Table 7 indicates, there were only three cases in which P-T-M condition Ss lacked this knowledge.

Table 7 Numbers of children in each presentation condition who failed the verbal knowledge tests.(1)

Modifiers	Presentation conditions		
	P	P-T	P-T-M
Yellow/pink (knife)	2(2)	4	1
Standing up/lying down (horse)	0	0	0
Red/green (teapot)	4	4	2
Standing up/kneeling down (giraffe)	0	0	0

(1) In one cell only does the number of rejections on the requirements task fall if the Ss failing the verbal knowledge test are excluded. This cell is for the pink knife, condition P-T. The fall - see Table 5 - is from five to four.

(2) Almost all the Ss who passed the verbal knowledge tests co-ordinated this knowledge successfully on the relevant co-ordination task. The only exceptions were two Ss in condition P for the pink knife.

2.3.3 Discussion of the results of Studies One and Two

The major findings of these studies should first be summarised. To begin with, Study One demonstrated that when considering preschool children's judgements of correspondence between objects and pictures, a clear distinction should be made between those correspondences which are required and those correspondences which are preferred. In particular, it was consistently found that whilst often, few requirements are made for either shape or colour correspondence respectively, correspondence with regard to both these dimensions is generally preferred. Study One identified two factors which influence the correspondences which young children require. The first of these concerns the relationship between the object and picture; more particularly, it was found that many young children reliably reject certain pictures which are discordant with regard to type-defining values. The second factor which was found to influence correspondence requirements is the manner of presenting the object;

specifically, if instead of being physically presented objects are described with a type name plus a single modifier, a large number of children require (in addition to the constraints of the first factor) that pictures should not be discordant with regard to the property cited by the modifier.

Study Two examined the influence of these two factors upon children's correspondence requirements more precisely. In relation to the type-discordant pictures which are rejected (factor one) this study gained evidence which suggests that those type-discordant pictures which are most likely to be rejected are those which are misleading with regard to the type of the object; most importantly, this effect was found to be independent of shape and/or colour correspondence per se. Thus it was even found that the great majority of young children do not reject a picture which is discordant with regard to both the shape and the colour of the model so long as the type of the model is portrayed unambiguously. Study Two also confirmed that the systematic rejection of discordants which are misleading as to type is independent of the manner of presenting the object. In relation to the influence of the giving of modifiers upon correspondence requirements (ie., factor two), Study Two showed that when modifiers are given in association with a physical object presentation they only have a marginal effect upon correspondence requirements. This result suggests (cf., Section 2.3.1 (c) ii) that the absence of a physical presentation of objects in the verbal presentation condition of Study One did facilitate the modifier effects obtained by that study.

These results have some significant implications. Consider first the finding that preschool children generally prefer absolute correspondents to partial correspondents. It follows from this finding that young children can perceive more than one dimension of correspondence simultaneously. Such a conclusion is not however consistent with traditional assumptions concerning young children's ability to co-ordinate information. In particular, the present finding severely undermines the rationale of the choice-preference studies-which have been based implicitly, if not explicitly, upon the assumption (cf., Section 2.1) that young children cannot perceive more than one dimension of correspondence simultaneously. It is evident that there are no grounds for adopting Corah's suggestion (cf., Section 1.3) that young children's performance on such tasks should be understood in terms of centring upon one or another dimension (such centring necessarily being an involuntary focussing of attention on the part of the child). The finding that preschool children often prefer absolute concordants indicates then that at least insofar as simple two-dimensional comparisons are concerned, young children may make satisfactory judgements of logical identity. Some consideration has previously been given (cf., Section 1.2) to Vurpillot's suggestions that logical identity is not correctly judged until six years of age. One reason for the present success may be that preschool children tend to grasp the desirability of correspondence between an object and a picture of that object whereas they may not so readily grasp the requirement for logical identity when judging picture pairs as 'the same' (cf., Section 1.4.2). It is evident however that Vurpillot's studies require more rigorous comparisons than the present studies and it may indeed be that children are unable to make such detailed comparisons until six years or so. Clearly, however, the level of co-ordination exposed by the present findings is greater than Vurpillot's conclusions would lead one to suppose.

Consider next the present findings concerning preschool children's correspondence requirements when objects are physically presented. It is evident from the readiness with which subjects tolerated discordants which failed to correspond to the models on shape or colour or even both shape and colour that young children do not in fact have a very satisfactory understanding of the correspondences which are demanded in valid pictures of specific objects. The case of the widespread acceptance of the picture of a purple narrow tapered candle as a valid picture of a blue spherical candle merits particular mention; here the perceptual correspondence between object and picture is minimal and instead, those correspondences which there are, are primarily nominal and functional.[30] Young children would seem then, on the present correspondence task at least, to place little value on having an accurate pictorial illustration of the model object (even though - as the preference data indicates - they have the potential to demand perceptual

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[30] Correspondences that is, between object and pictured object.

correspondence). It cannot be over-stressed however that despite the laxity of the correspondence requirements made, there is nevertheless, a very clear and systematic pattern to these requirements. Specifically a majority of subjects did not accept pictures which were misleading as to the type of the relevant model; thus for example, whilst a blue giraffe was frequently judged to be an acceptable picture of a giraffe, a zebra was not generally judged to be an acceptable picture of a horse. The requirement made then appears to be for a kind of symbol; that is, for any unambiguous representation of the object's generic type. Now whilst such symbol-based correspondence requirements are by no means equivalent to mature perceptually-based correspondence requirements, there can be no doubt that the symbolic requirements do make very sound informational sense. By this it is meant that the correspondence requirements which were made were precisely those (and no more) which ensured that the pictures were spontaneously nameable with the same type name as the model object. When it is remembered that subjects were asked to ensure that the teddy could use the pictures to remember what was in the boxes it becomes apparent that, in the language of information theory, they can be said to have been following what has been described as the 'minimum redundancy hypothesis' (cf., Freedle, 1972); that is, subjects systematically provided only the information which was absolutely necessary. In the light of these considerations it seems highly inappropriate to describe subjects' toleration of discordants in terms either of erratic 'centring' on perceptually salient features or of relatively persistent centring on a requirement for shape correspondence. Rather, the dimensions of correspondence upon which children are prepared to base an acceptance of a picture are limited systematically to those upon which an unambiguous communication of the correct type depends. If such behaviour is however to be described in terms of centring, it is evident that at the very least, the centring patterns are characterised by a considerable but ordered flexibility.

Consider next the results obtained for the correspondence requirements tasks when objects were described at the level of the noun phrase. A critical question which arises is why the pictures discordant with regard to the type-modifying values tend to be widely rejected only when the object descriptions are given in the absence of the additional physical presentation of these objects. The most likely explanation for this rests on the Study Two finding that when objects are physically presented (with no verbal labels) preschool children spontaneously require only that pictures be non-misleading as to type. This finding suggests that straightforward physical object presentations set up type levels of responding in young children (much as Aristotle described - cf., Section 2.2.4). This consideration therefore implies that when the giving of an appropriate modifier accompanies a physical presentation of an object, a conflict is set up; that is, subjects about to make a type-based correspondence judgement are referred to more specific object information to which they would not normally attend. Such subjects are then required (according to this argument) either to ignore the modifier given and respond at the type level or to transcend the limitations of the type set so as to take account of the modifier given. In the event, most young children faced with these alternatives fail to transcend the limitations of the type set. There is some circumstantial evidence which supports the legitimacy of this interpretation. Specifically, informal observation did indicate that of those subjects who were presented with objects and given in addition, descriptions of these objects at the level of the noun phrase, a large number re-named the objects at the type level.[31] Furthermore, the present view also accords with Luria's (1961) description of the development of verbal controls on behaviour (cf., Section 2.1). Specifically, Luria (op. cit.) reports that when children first become responsive to adults' speech, there is an initial stage in which overt verbal instructions are unable to alter an action once it is begun. Thus given that physical object presentations do elicit type-based responses, the finding that young children's responsiveness to modifiers is increased by the omission of physical object presentations is consistent with Luria's account.

It should be emphasised that the instability of the effects of the modifiers according to the conditions of object presentation does not indicate that the majority of children participating in the

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(31) Interestingly, it was also observed informally that many of the subjects who were presented with objects and given no accompanying descriptions, tended to name the objects themselves at the type level.

present studies were only just beginning to respond to verbal controls. In particular it should be re-iterated (cf., above, this section) that there is no sound reason - in informational terms - why subjects should have required correspondence with regard to type-modifying values. The modifiers did not function as specific instructions nor did they reinforce specific instructions; rather they merely carried an oblique hint that the dimensional values which they coded could (and perhaps should) be attended to. It is these hints which elicited diverse effects according to the circumstances of the object presentations. One factor which may have contributed to the modifier effects obtained when objects were not physically presented is that, with the objects sealed in boxes, the children may have treated the correspondence task as a game in which they were to demonstrate their memorial power.

There is some evidence in the present studies however that the effects of the modifiers upon correspondence judgements were strictly limited. Specifically, it is apparent from Study One (cf., p. 68 Table 1, object row four, data column two), that when two relevant modifiers are given in the absence of a physical object presentation, most preschoolers do not reject pictures which are discordant with regard to just one of the two dimensions coded. It is important to notice that these discordants were nevertheless concordant with regard to the other modifier; however clearly, subjects' responsiveness to modifiers was, even in the absence of physical object presentations, incomplete.[32] This consideration does suggest that young children's sensitivity to verbal controls is less developed at the level of the noun phrase than it is at the type level; indeed the type level responding has all the appearances of being a purely self-regulated verbal control on correspondence judgements.

At this point, the wider implications of the present findings should be reviewed. It is clear that the level of cue co-ordination exhibited by the preschoolers tested was considerable. It is evident from the preference data that many of them typically (and spontaneously) encoded both the shape and the colour of the referent

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[32] In addition Study Two showed that when noun-phrase level descriptions accompany physical object presentations, even a picture discordant with regard to both modifiers given (ie., the purple tapered candle) is not rejected very often.

objects (for both physical and verbal object presentations). It is also apparent that the toleration of discordants found on the correspondence requirements tasks was systematised and was systematised moreover in terms other than an attentional bias for shape correspondence relative to colour correspondence. These results are clearly not consistent with the widespread view (cf., Section 2.2.1) that young children, in attending to objects in the world, always attend more to the shapes than to the colours. Nevertheless, in terms of correspondence requirements at least, there does seem likely to be an <u>effective</u> attentional shape bias arising from the fact that shape discordances, more often than colour discordances, are likely to involve a change in the type-identity of a picture (cf., Section 2.3.1 (c) ii).

It was suggested above (Section 1.1) that children's judgements of correspondence between objects and pictures of those objects might reveal something about the kind of concepts of these objects which children have. In Section 2.1 it was suggested that these concepts might be type-based. It is clear from the requirements data however that whilst young children do indeed place a special emphasis upon the dimensions of correspondence upon which an unambiguous communication of type depends, they do not spontaneously place a corresponding emphasis upon all type-defining values. Now, this finding does not necessarily indicate that young children's concepts are not fully and comprehensively based upon object types; it may merely be - as has been noted above - that the present subjects adopted a minimum redundancy approach for the correspondence requirements tasks. A critical question which therefore arises is whether, when given traditional classification tasks, preschool children's spontaneous categorisations are, for all kinds of object, groupings which are based upon type (as defined in Section 2.1) independently of shape or colour correspondence per se. The studies reported in Chapter Three tackle this issue.

CHAPTER THREE: CLASSIFICATION OF REPRESENTATIONAL MATERIALS BY PRESCHOOL CHILDREN AND ADULTS

3.1 Statement of the issues to be investigated

Two studies are reported in the present chapter. The first (reported in Section 3.2) investigated whether preschool children's spontaneous categorisations indicate that they judge pictures discordant with regard to type-modifying values to be more alike than pictures discordant with regard to type-defining values (independently of whether or not the type-discordant pictures are misleading as to type). If it is found that children's spontaneous groupings are based upon type-correspondence independently of shape or colour correspondence per se then this would disconfirm some contemporary views concerning the kinds of concepts which young children acquire (cf., Section 3.2.1).

The second study reported in the present chapter (Section 3.3) examined whether adults' concepts are organised in terms of type. Additionally however, this study investigated whether type effects are detectable when the relative salience of the colour and shape discordances is controlled. The effects of changes in salience patterns upon preferences for colour versus shape correspondence has (as has been noted in Section 2.1) been documented in the choice-preference literature. It might therefore be suggested that any type effects which are gained in the present studies (ie., any systematic rejection or avoidance of type-discordances independently of shape or colour correspondence per se) may be due not to subjects' sensitivity to type-discordances and to their conscious efforts to avoid such discordances but rather simply to the fact that the type-discordances happen to be the most salient differences and that these salient discordances are systematically avoided.[1] The study reported in Section 3.3 constituted then an investigation of whether

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[1] This salience argument can be made in relation to the results of the Study Two correspondence requirements tasks. Thus it could be contended for example that subjects did not reject the colour discordant which was misleading as to type (the zebra that is) because it was type-misleading but simply because it was a particularly striking discordance. Such an argument does not in this case appear to be particularly forceful however since it is apparent that the same subjects failed to reject, to any significant extent, a number of other fairly striking colour discordants (most notably, the pink and blue 'sandwich' and the blue 'giraffe').

there is any evidence that adults prefer to group by type independently of shape or colour respectively when the relative salience of the dimensional discordances is controlled.

The two studies reported below each employed hybrid versions of standard choice-preference methods. Such methods do have classical status as conceptual tasks (see, for example, Werner, 1948).

3.2 Study Three: A study of preschool children's spontaneous categorisations

3.2.1 Introduction

There is a long tradition of research into young children's performance on classification tasks. This research has found that young children's first-choice groupings are typically based upon a series of changing criteria with no overall systematic basis. Traditionally, these findings are held to support the classical view that the young child is, in some way, 'pre-logical' (cf., Section 1.3). Recently, however, it has been demonstrated by Rosch and some of her associates (Rosch et al., 1976) that most young children <u>will</u> make systematic <u>taxonomic</u> groupings of representational material <u>if</u> it is possible to make such groupings at her basic-level of abstraction.

It has already been observed (cf., Section 1.3) both that Rosch assumes that shape correspondence is necessarily implicit at the basic level of abstraction and that this assumption would appear to be untenable for certain kinds of object. Additionally, it has been noted, Rosch fails to recognise that colour correspondence may be implicit at the level of abstraction which she calls basic. Rosch is not alone in emphasising the role of shape relative to that of colour in concept development. Thus, for example, in the literature on concept acquisition in the literature on language acquisition, Nelson, citing Clark's conclusion (eg., 1973; 1974; see also Clark and Clark, 1977) that children never classify on the basis of colour in their over-extensions observes:

> "Color .... is a highly salient dimension for young children although it is rarely useful for the purposes of identifying concept members and is, in fact, seldom used for category generalization by young children (1974; p. 278)."

The present study is primarily concerned with exploring whether, when preschool children are given the opportunity to make spontaneous taxonomic categorisations of representational materials on the basis of shape or colour respectively, their groupings are indeed always based upon shape or whether rather, their groupings are based (wherever possible) upon whichever of these dimensions is a type-defining value. It has been previously noted however (cf., Section 1.3) that the exhibition of systematised first-choice groupings is not sufficient to satisfy the classical criteria for a demonstration of genuine classificatory skill. Traditionally, children are required also to reclassify the materials, by a deliberate act of decision, on a completely different basis. This second requirement is made on the basis that natural concepts are arbitrary. Now it has already been noted (Section 1.3) that there are considerable grounds for supposing that natural concepts are not arbitrary and that young children may therefore possess mature natural concepts even if they are unable to treat representational material arbitrarily. Nevertheless, in view of the stress that has been laid upon this ability in the past - and in view of its evident importance for the more symbolic (or less concrete) forms of thought - the present study will also investigate children's ability to reclassify the materials presented.

The method employed in the present study was based upon a variant of the standard choice-preference procedure which has often been used in the past (eg., Descoeudres, 1914). Specifically, children were presented with a series of sets of three pictures each and were required to select, for each set, the pair of pictures which they judged to be most similar. Five picture sets were presented to each child; these sets are reproduced in Table 8 (p.101). The picture sets were selected so as to be directly comparable to the materials used on Study Two (cf., Section 2.3).

Each picture set (cf., Table 8) was devised so that the three picture pairings it permitted comprised one pair with the same colour, one pair with the same shape and a third pair with neither the same colour nor the same shape. In four of the five picture sets only one picture pair portrayed the same type; in two of these sets (that is, the cutlery and teapot sets) the type correspondence was mediated by shape and in the remaining two sets (that is, the horse-zebra and giraffe sets) the type correspondence was mediated by colour. In the fifth picture set (ie., the balloons) the three pictures were all of the same type.

In relation to these materials it was predicted that first-choice groupings would be by type independently of shape or colour correspondence per se. It was therefore expected (cf., Table 8) that subjects would choose the two horses on Set One, the two giraffes on Set Two, the two forks on Set Three, the two teapots on Set Four and finally, any two of the three balloons on Set Five. No comparably specific hypotheses were made concerning the likelihood of subjects being able to make reclassifications; it was anticipated however that the likelihood of regrouping would be at a maximum in the case of the balloon set - in which a second classification may be made on the basis of type - and that, of the remaining sets, subjects would (this expectation being based on the results of Study Two) be more likely to reclassify the sets in which each picture unambiguously represented the same type (ie., the giraffe and teapot sets) than to reclassify the sets in which one picture was of a clearly different type to the rest (ie., the horse-zebra and fork-spoon sets respectively).

3.2.2 Method

3.2.2 (a) Subjects

Twenty-four children, 13 boys and 11 girls (mean age 3:9 years; age range 3:1 - 5:0) attending a single nursery class in Edinburgh participated in the study.

3.2.2 (b) Materials

The materials used were the 5 sets of 3 pictures each previously described (cf., Section 3.2.1). Each picture set was mounted horizontally on a separate card under a single flap.

3.2.2 (c) Design and procedure

The 24 Ss each received the same choice-preference task followed by a type knowledge test in a single session.

The procedure followed in the choice-preference task was begun by asking each S to choose one of the five picture cards; the card flaps were all closed and consequently each S was unaware of the contents of the card chosen. It was then explained that under the flap on each card were some pictures and that, for each card, he (or she) would be asked to:

> "Show me (ie., the E) two pictures that are the same in some way."

The pictures under the flap of the chosen card were then exposed and the critical request (using the wording given previously) was made. If a S made a first grouping he was then asked:

> "Can you do it another way now? Are there two others that are the same in some way?"

When this procedure had been completed for the first picture card it was then repeated for each of the remaining cards in turn. For these subsequent cards however, the request for first-choice groupings was only made after the pictures had been exposed.

The rationale for presenting the type knowledge test was (as in the case of Studies One and Two) that the exhibition of type-groupings presupposes that Ss are aware of the type-status of the items pictured. The procedure followed was virtually identical to that employed for Study Two (cf., Section 2.3.1 (d)). The differences were that in the present test, the pictures remained mounted in their sets and the E pointed to each picture in turn. The picture sets were presented in the same order as that in which they were received for the choice-preference task.

The relative positions in which the three pictures in each picture set appeared (ie., left, middle or right) were balanced between Ss. (The six subgroups thus formed were balanced for mean age.)

3.2.3 Analysis of results

3.2.3 (a) First-choice pairings

Table 8 indicates (cf., data columns one-to-five) the nature of Ss' first-choice pairings for each picture set. It is evident from the first column that, in the case of three of the sets, a number of Ss made a second pairing simultaneously; that is, these Ss indicated when asked for a single pairing that more than one pairing could be made. These responses must, of necessity, be ignored in the analyses of the relative preferences for shape versus colour pairings within the relevant sets; additionally, these analyses must also ignore the relatively few cases where Ss paired the two non-pivot pictures[2] or else made no pairing at all. In considering the

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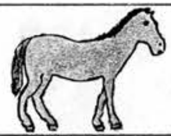
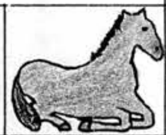
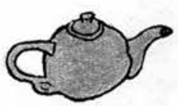
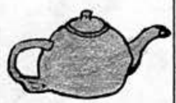
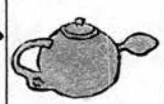
(2) See Table 8, note (1) for the definition of this term.

Table 8 Breakdown of the numbers of first-and second-choice pairings made for each picture set.

Picture sets (1)			Breakdown of first-choice pairings (2)					
pivot picture	non-pivot pictures		by both shape and colour	by shape	by colour	of 2 non-pivots	no pairing	total percentage of Ss making 2 pairings
			-	1(1)	21(5)	-	2	25
			-	1(1)	23(2)	-	-	12.5
			7 (3)	15(8)	2(0)	-	-	62.5
			5 (4)	3(1)	13(3)	1	2	37.5
			5	7(4)	11(4)	1	-	54

(1) The pivot picture is the picture which must be used to make both the colour pairing and the shape pairing in each set.

(2) The number of Ss making satisfactory second pairings on request is indicated in brackets.

(3) Two of these Ss considered that the 2 non-pivots could also be grouped.

(4) One of these Ss considered that the 2 non-pivots could also be grouped.

remaining data (ie., data columns two and three respectively) it is evident that with the exception of the pairings made with regard to the teapot stimuli, the great majority of first-choice pairings were based upon type independently of shape or colour correspondence per se. Thus, in the case of both the horse-zebra and the giraffe sets, Ss paired overwhelmingly by colour rather than by shape (applying χ^2 for 1-sample case, $p \angle 0.001$ for each comparison); on the other hand, in the case of the fork-spoon set, Ss grouped by shape rather than by colour (applying χ^2 for 1-sample case, $p \angle 0.01$) whilst in the case of the balloon set there is no significant difference between the preferences for shape versus colour correspondence (applying χ^2 for 1-sample case, $p \angle 0.5$ only). Nevertheless, it should additionally be noted with regard to the balloon pairings that Ss almost universally made pairings based upon a dimensional correspondence rather than selecting the two non-pivot pictures - which in this case are type-concordant.

The first-choice pairings arising in relation to the teapot stimuli are, as indicated above, not consistent with the type hypothesis. Specifically of those Ss who made a clear and legitimate first-choice grouping, the overwhelming majority of Ss preferred to pair by colour rather than by shape (applying χ^2 for 1-sample case, $p \angle 0.02$). This result may be partially attributable to large numbers of Ss having failed to notice that the type-discordant did not have a proper spout. Table 9 shows that the number of Ss who failed to reject the teapot-spoon stimulus on the type knowledge test was more than that occurring for any other of the type-discordants. Interestingly, when the 13 Ss who made type errors with regard to this set are excluded from the comparison of the first-choice pairings based on shape versus colour, the comparison becomes insignificant (χ^2, 1-sample case, $p \angle 0.2$).

Table 9 Breakdown of performance on type knowledge test.

Stimulus Sets	No. of Ss performing adequately	No. of Ss accepting type-discordant	No. of Ss rejecting type-concordant(s)
Horses-Zebra	16	8	-
'Giraffes'	14	9	1
Forks-Spoon	22	2	2
'Teapots'	11	11	2
Balloons	24	-	-

3.2.3 (b) Second-choice pairings

As was noted in the previous section, a number of Ss made second legitimate pairings spontaneously (cf., Table 8; data column one). This effect was most pronounced on the fork-spoon set and this trend is reflected in the total numbers of Ss who carried out successful re-groupings (cf., Table 8; data column six). It is evident from the latter figures that up to 62.5% of Ss regrouped; however it is also clear that there is a considerable range between the various sets in the numbers of second pairings occurring. In particular, the numbers of second pairings occurring in relation to the cutlery and balloon sets tended to be markedly higher than the rest. Specifically, second pairings were more frequent in the case of the cutlery set than the horse-zebra set (applying sign test, $p = 0.022$), than the 'giraffe' set (applying sign test, $p = 0.002$), and, to a lesser extent than the 'teapot' set (applying sign test $p = 0.11$).(3) Similarly, second pairings were more frequent in the case of the balloon set than the horse-zebra set (applying sign test, $p = 0.016$), than the 'giraffe' set (applying sign test, $p = 0.002$) and, again, much less markedly than the 'teapot' set (applying sign test, $p = 0.218$).

3.2.4 Discussion

The main finding of the present study was that, with the exception of the results concerning the 'teapot' picture set, preschool children's first-choice taxonomic groupings were, when a legitimate preference was expressed, based upon type independently of shape or colour correspondence. Thus, in the case of the horse-zebra and 'giraffe' sets, subjects paired spontaneously by colour; alternatively, in the case of the fork-spoon set subjects paired by shape whilst, with regard to the balloon set, subjects paired either by shape or by colour. The results obtained in relation to the 'teapot' set would appear to be partially explainable in terms of a failure on the part of many subjects to spot the spout error in the

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(3) It should be remembered in interpreting these figures that the number of regroupings occurring in relation to the 'teapot' set seems likely to have been inflated by the relatively high number of Ss who evidently did not notice the type errancy of the type-discordant (cf., Section 3.2.3 (a)).

type-discordant stimulus; because however even those subjects who did spot this discordance did not group systematically by type it may also be that subjects did not consider such a minor shape-type discordance (cf., Section 2.3.1 (c) ii) to warrant the ignoring of the stimulus. Nevertheless, since it may be too that some subjects only recognised this stimulus to be type-discordant when they were asked to examine it individually on the type knowledge test[(4)], firm conclusions regarding the explanation for the non-type based results obtained for the 'teapot' picture set cannot be drawn.[(5)] What does seem evident however is that young children, in making spontaneous groupings, systematically avoided using stimuli which were clearly type-deviant when type-concordants were freely available. This finding has several important implications. The first of these relate to theories of the nature of children's concepts of everyday objects. Specifically, the present results suggest that young children possess taxonomic concepts of such objects in which the relative dominance of shape and colour information varies strictly according to whether correspondence with regard to these dimensions is assumed by the type name. These results clearly add credence to the present view (cf., Section 1.3) that children learn very swiftly to organise their concepts of everyday objects in terms of the names by which objects are commonly called. In addition the present results provide interesting contextual information concerning the interpretation of one of the results of Study Two; in particular, whilst young children were found in Study Two to tolerate non-type misleading type-discordants (eg., blue giraffes) as 'correspondents' of the appropriate objects, it is evident from the present findings that young children generally prefer correspondences to be based upon type-defining values rather than upon type-modifying values even if the modifier-concordants (that is the type-discordants) are not misleading as to type.

The present findings of type-based groupings suggest that a

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(4) This effect might be expected to be more marked for this relatively obscure discordance than for each of the other type-discordants.

(5) A very much more thorough examination of young children's judgements as to the adequacy of partial shape-type discordants is reported in Section 5.2.

number of previous accounts of the nature of young children's concepts of objects (eg., those of Clark and Nelson respectively - cf., Section 3.2.1), have attributed to shape too prominent a role relative to colour. In addition, the present finding confirms the view expressed previously (cf., Section 1.3) that Rosch and her associates have over-estimated the degree of correlational structure in the world. The present findings also have important implications for the methods which should be used to investigate people's concepts of everyday objects. Specifically, these findings indicate that the appropriate methods to use must be sensitive to the variety of bases upon which concepts may be grounded and must assess these bases systematically as a function of the particular kind of representational material used. Unless this is done it is apparent that groupings which are systematically co-ordinated in terms of type information may appear either to be dimensionally biased or else erratic. Thus, one reason why the importance of colour relative to shape has been downgraded in the past would seem to be that insufficient attention has been paid to the kinds of object for which colour plays an important role. The present studies have focussed on shape and colour bases but clearly a number of other correspondence bases (eg., auditory, functional and textual) seem likely to be critical for the acquisition of other kinds of concept and children's sensitivity to all these other bases warrants future investigation.

A second finding of the present study was that, in the case of the fork-spoon and balloon picture sets, a majority of the children regrouped the stimuli either spontaneously or upon being asked to do so. This result is significant because the ability to reclassify stimuli by a second grouping criterion is traditionally regarded as a fundamental requirement for the demonstration of genuine classificatory skill and because there is a consensus of opinion (cf., Section 1.3) that there is little or no freedom of choice in any of the grouping criteria which young children adopt. Thus, according to Reichard et al., (1944), whilst shifts in grouping principles have not generally been detected until about five-years, only at around seven-to eight-years can the majority of children evidence this ability and only beyond eight-years do 75 per cent of children achieve it.[6] The question arises then as to why, in the present study, 54 per cent of subjects regrouped the balloon set and 62.5 per cent of subjects regrouped the fork-spoon set.[7] It had been expected, on the basis of the type hypothesis, that a relatively high proportion of the children would regroup the balloon set (cf., Section 3.2.1); that, however, a stronger or even comparable effect would be gained with the fork-spoon set had not been anticipated. An important part of the explanation for the regrouping effect found for the cutlery set would seem to lie in the nature of the functional cues which reinforced the colour-based, cross-type grouping (ie., the pairing of the blue fork and blue spoon and the ignoring of the orange fork). A fork and spoon constitutes a legitimate table setting and whilst most of the children tested were perhaps unaware of this, it does nevertheless seem reasonable to suppose that even for young children, these items of cutlery possess considerable intrinsic and extrinsic functional significance. In fact the widespread regroupings which occur in relation to the balloon set would also appear to be largely functionally mediated; whereas however the functional cues operate at a type level of abstraction in the case of the balloons, they operate at a higher level of classification in the case of the cutlery. The explanation then for why regroupings occur for these two sets would appear to be that there are <u>sound reasons</u> for making them which accord with children's experience of object groupings in the world. By contrast, in traditional studies, children have not generally been given the opportunity of making groupings which accord with their experience of the world; rather, children have been required to make <u>arbitrary</u> groupings which transcend the classificatory structure in the world. It is noteworthy in considering the significance of the present findings that Fodor (1972) has argued that functional groupings are no less abstract than more traditional grouping criteria:

> "What knives, spoons and forks have in common is not that they look, feel etc. alike but that they are used for analogous purposes ... you will hardly say

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[6] The figure of 75 per cent is significant because it is the criterion set by Piaget (1928) for success on a classification task.

[7] N.B. The mean age of the children who regrouped these stimuli was 4:2 and 4:0, respectively.

that this defining property (being used for eating) is less abstractly related to sensory data than the defining concept (tableware) (p.90)."[8]

3.3 Study Four: A study of adults' spontaneous categorisations

3.3.1 Introduction

The general significance of this study has already been outlined (cf., Section 3.1). In addition it should be noted that if it is the case that adults evidence a preference for correspondence with regard to type-defining values rather than correspondence with regard to type-modifying values independently of shape or colour correspondence per se when the relative salience of the shape and colour differences is controlled for, then this will demonstrate unequivocally that the possession of type-based categorisation preferences is not a characteristic of young children merely but is a hallmark of mature conceptual judgements.

The choice-preference procedure chosen for the study was the standard format (described in Section 1.3). The materials used were exclusively pictorial since it was considered that pictorial materials would provide the most adequate means of controlling salience patterns. A single critical array was used; this array has already been presented (cf., Figure 8, p.45). The model stimulus featured in Figure 8 was presented to the subjects in association with four separate type labels and for each presentation subjects were required to choose between the same two choice-stimuli the choice stimulus which they judged to be most similar to the model. The four type labels given were 'SMARTIE', 'CHOCOLATE', 'MALTESER' and 'WINEGUM', respectively. It is evident that these four types represent the four kinds of type investigated in Study One (cf.,

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[8] It should be noted however that the classification task used in the present study does fail to fulfill two conditions which are often made in classification tasks. Firstly, because there were only three items in each picture set it was not possible for subjects to demonstrate that they could hold fast to a single criterion of grouping over multiple groupings (cf., Section 1.3 for a discussion of this requirement). Secondly, it is sometimes stressed that conceptualisation requires the isolation of the defining criteria (eg., Vygotsky, 1962) and it has therefore been customary in the past to use objects which vary not only with regard to those properties which are systematically varied but which also vary randomly with regard to a number of other properties (such as size, weight and texture).

Section 2.2); that is, smarties occur 'in' different colours but are always round; chocolates comparatively are almost always brown but occur in different shapes; maltesers are always both spherical and brown whilst winegums can be a variety of shapes and colours (cf., Figure 6, p. 31). Assuming then that subjects are familiar with each of these types; it will be expected that if they do value correspondence on type-defining values more highly than correspondence on type-modifying values independently of shape or colour correspondence per se, then they will select the shape correspondent when the label 'SMARTIE' is given and the colour correspondent when the label 'CHOCOLATE' is given. By contrast, the results which the type hypothesis would predict for the 'MALTESER' and 'WINEGUM' labels are much more problematic to determine; for each of these labels however the choices for the shape versus the colour correspondents would be expected to be more evenly distributed.

One inference which can be drawn from several of the findings reported in Chapter Two is that if, instead of being described merely with a type name, models are also described with appropriate modifiers, the effect resulting tends to be a reduction in children's preferences for the pictures corresponding to the type-defining values relative to the pictures corresponding to the type-modifying values. The strength of these effects would appear for preschool children at least, however, to vary a great deal according to the number of modifiers given and according to whether or not the models are also presented physically. One question which therefore arises is how the giving of relevant modifiers in addition to type names influences the relative preference exhibited by adults for type-defining value and type-modifying value concordants respectively. Clearly the degree to which any adult type effects are susceptible to such verbal influences might be expected to have considerable implications for how the verbal effects obtained with children should be interpreted. This question was therefore examined in the present study. Specifically, an additional group of adult subjects were each presented with the array illustrated in Figure 8, four times; the labels given to these subjects were, 'BROWN SMARTIE', 'ROUND CHOCOLATE', 'MALTESER' AND 'BROWN, ROUND WINEGUM', respectively.

3.3.2 Method

3.3.2 (a) Subjects

Thirty-two first-year psychology students (8 men and 24 women) studying at the University of Edinburgh took part in the study.

3.3.2 (b) Materials

Each S was given 2 instruction/response sheets, one at a time, in a fixed order. Each sheet contained an invariant series of horizontal arrays; each array comprised 3 pictures: a model picture in the left hand column and two 'choice pictures' in the second and third columns. Four arrays - in which the models were unlabelled - appeared on the first sheet. The second sheet contained 7 arrays in each of which the model pictures were labelled; these labels were either at the type level or at the level of the noun phrase depending on the presentation condition to which a S had been assigned. Samples of the two kinds of instruction sheet are reproduced in Figure 14. It should be noted in relation to these sheets that although the array sequences were invariant the relative position of the choice-pictures (ie., whether immediately next to the model or not) was balanced in each of the two presentation groups.

3.3.2 (c) Design and remaining procedural aspects

All Ss received the same sheet 1; then in the same session, 16 of them (randomly determined) were presented with a second sheet in which the model pictures were labelled with type names and the remaining 16 Ss received the sheets with labels at the level of the noun phrase. The median age of both conditions was 18 years and of the 8 male Ss, 3 were in the type presentation condition and the remaining 5 were in the noun phrase presentation condition.

The rationale for presenting the unlabelled arrays first (sheet 1) was that each student's baseline correspondence preference according to the natural salience patterns of each array could then be established; the precise influence of each label upon this natural preference could then be determined for each of the 4 critical arrays on sheet 2. The 3 non-critical arrays (ie., of the 'banana', 'table' and 'cheese' respectively) - each presented on both sheets 1 and 2 - were presented as distractors; the intended function of these arrays was to draw the students' attention away

Figure 14 Samples of the two kinds of instruction/response sheet used.

(a) Sample Sheet 1

You will no doubt have noticed the coloured shapes shown below. You are asked – if you will! – to make some qualitative choices in relation to these pictures. Because each of these choices is qualitative there are no 'right' or 'wrong' answers. In the columns below, the far left column is headed, 'model pictures' and the two middle columns are headed 'choice pictures'. All you are asked to do is to choose for each row of pictures which of the 2 choice pictures seems to you to be most like the model picture. For each row of pictures please indicate your choice by circling it in the last column.

Model Pictures	Choice Pictures A	Choice Pictures B	Choice Pictures Chosen
			A B
			A B
			A B
			A B

(b) Sample Sheet 2[1]

Again there are no 'right' or 'wrong' answers. Proceed as for Sheet 1 but this time please note that the model pictures have labels.

Model Pictures	Choice Pictures A	Choice Pictures B	Choice Pictures Chosen
(brown) smartie			A B
banana			A B
malteser			A B
(brown round) winegum			A B
(red) table			A B
(cube of) cheese			A B
(round) chocolate			A B

Thanks for your help. Finally please supply the information asked for below.

i) Sex: M/F
ii) Age:

(1) If Ss were in the condition receiving type labels only, they received a second sheet in which the modifiers (bracketed in illustration) were omitted.

from the logical identity of the critical arrays on sheet 2.

Ss were tested in groups of about 8 Ss each; when each S had completed sheet 1, he or she was given the appropriate second sheet (each S had a sheet number code).

3.3.3 Analysis of results

Table 10 indicates how the students' preferences for the shape versus the colour concordant for the critical array shifted according to how, if at all, the model picture was described. The first point to be observed is that in both presentation groups (see the first data columns in Table 10, parts A and B, respectively) the baseline correspondence preferences for the unlabelled model were equally

Table 10 Number of students choosing the shape and colour concordants respectively as a function of presentation condition.

A. Type presentation condition:

Students' choices	Unlabelled model	Model named as			
		smartie	chocolate	malteser	winegum
shape concordant	7	16	1	4	16
colour concordant	9	0	15	12	0

B. Noun-phrase presentation condition:

Students' choices	Unlabelled model	Model named as			
		brown smartie	round chocolate	malteser	brown, round winegum
shape concordant	9	13	4	9	13
colour concordant	7	3	12	7	3

distributed between the shape and colour concordants. Consider next the effect of the type labels upon the students' correspondence preferences. It is apparent (cf., Table 10; part A) that these labels had marked effects. Thus, when the label 'SMARTIE' was given, all the pertinent students then preferred the shape concordant. The shift from these students' baseline performance is significant (applying sign test, p = 0.004). When however the label 'CHOCOLATE' was given, the shift from the students' baseline choices was for a greater preference for the colour concordant. This shift is also significant (applying sign test p = 0.032). When the label 'MALTESER' was given there was a slight shift from the baseline responses to a greater preference for the colour concordant; this shift however is insignificant (sign test, p = 0.376). The result obtained with the label 'WINEGUM' was unexpected; specifically, there was a significant shift from baseline responding to a greater preference for the shape concordant (sign test, p = 0.004).

Consider finally, the effect of the noun phrase labels upon correspondence preferences (cf., Table 10; part B). It is evident that the effect of the modifiers is to disrupt the pattern of the correspondence preferences obtained with the type labels alone. Indeed, with the noun phrase labels there are no significant shifts in responding from the baseline preferences (the strongest shift is for the 'BROWN CHOCOLATE' label which attains a p-value - sign test - of 0.18). Although, however, the modifiers clearly disrupted the pattern of responding obtained in the type presentation condition it is nevertheless apparent that when both type names and modifiers were given, the type names were the primary influence in determining correspondence preferences. That this is so is evident from the direction of the preferences in the noun phrase presentation condition which, although weaker than the preferences in the type presentation condition are nevertheless in the same direction for each of the corresponding labels.[9] This effect can be supported statistically. Thus, performance with the labels 'BROWN SMARTIE' and 'BROWN ROUND WINEGUM', respectively, is significantly different from that occurring with the label 'ROUND CHOCOLATE' (applying sign test, p = 0.012 in each case).

3.3.4 Discussion

The present study indicated clearly that adults' correspondence preferences are very much influenced by how models are described. The main influence upon adults' preferences appears to be the type

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[9] This discussion does not of course apply to the 'MALTESER' label which was constant in both presentation conditions. There was, in any case, no significant correspondence preference evidenced for this label in either condition.

name which is given; however, the articulation of relevant modifiers does also influence adults' correspondence judgements. Concerning the influence of the type names the study indicated that adult subjects do prefer correspondence with regard to a type-defining value to correspondence with regard to a type-modifying value independently of shape or colour correspondence per se (cf., the results for the 'smartie' and 'chocolate' labels respectively). Additionally, for an object type where both shape and colour are type-defining values (cf., the results for the label 'malteser') there was no significant preference for either shape or colour correspondence. There was however one result which was not anticipated. Specifically, rather than producing roughly equal preferences for the shape and colour concordants respectively, the winegum labels generally elicited the choice of the shape concordant. This result is, however, not necessarily inconsistent with the type hypothesis. Specifically it would seem that whilst winegums are rarely either brown or square they are often green and/or roundish in shape.(10)

It would appear then from the present findings that the type of object serving as model is a fundamental basis of the natural correspondence preferences expressed by adults for representational materials. Clearly the present subjects were not responding merely to variations in the relative salience of shape and colour differences because these differences were fully controlled for. The implication of these results is then that adults' internal representations of many specific objects are organised in terms of type. In particular, the present findings illustrate the fallacy of the influential view expressed by Rosch and her colleagues (cf., Section 1.3) that human attention to everyday objects is necessarily governed by a psychologically defined correlational structure in which shape cues play a dominant role and colour cues play little if any role at all.

The finding of type-based categorisations in adults also has considerable relevance for the type effects found with preschool children in earlier studies reported here. In particular it is

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(10) N.B. Support for this suggestion may be derived from those justifications which subjects offered (informally) for their choice of the shape concordant when the winegum labels were given.

evident that type-based categorisations - for which the grouping criteria vary systematically as a function of the kind of material being categorised - do not reflect an immature approach to classification but indicate rather, a mature, adult-like strategy. Because, however, the relative salience of shape and colour differences were not controlled for in the studies with young children it is of course possible that the 'type' effects obtained with these children were in fact underwritten by salience effects rather than conscious type-based strategies. The salience argument seems likely to be invalid in the case of the results of Study Two (cf., footnote no. 1 p.96) but it does perhaps have some credibility as an explanation for the results of the first-choice groupings obtained on Study Three. The question of the degree to which young children are conscious of the groupings they select is paid some attention by a study reported below (cf., Section 4.3). It should be noted at this point, however, that the sweet materials used in the present study were piloted with preschool children but it became evident - surprisingly perhaps! - that insufficient numbers of them were sufficiently knowledgeable as to the pertinent type-defining values to provide an adequate test of the type hypothesis. This latter finding does emphasise that although young children do clearly possess many type-based categories, the incidence of type effects is likely to be considerably lower in the case of children than adults because of children's relative lack of type knowledge. This point is reinforced by the large numbers of subjects who did not judge the type discordants to be type discordant on the type knowledge tests in Studies One, Two and Three. Young children seem to be particularly lacking in knowledge about the discrepancy of colour-type discordants (cf., especially, Table 2, p 70). One factor which may be relevant here is that whereas the type status of shape-type discordants can often be deduced from subjects' knowledge of the functions of objects, this is very unlikely to be the case with colour-type discordants.[11]

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[11] There is some evidence for this distinction in the justifications given by subjects for their correspondence requirements in the pertinent studies. Thus whereas the diamond-shaped 'ball' for example, was often rejected by explanations such as,"'cause it won't bounce" or "because it might break, might burst ", the acceptance of the colour-type discordants was often justified in fantastical terms, thus, for example, acceptance of the purple 'orange' was justified with explanations such as: "apples change colour when they get old, aye" or "in Spain you do,'cause the sun's hot makes them go bad."

Some consideration should finally be given to the finding in the present study that type names were more influential in determining adults' correspondence preferences than relevant modifiers were. This finding has certain implications for the previous finding (cf., Section 2.3) that children who received physical model presentations with accompanying noun phrase descriptions generally rejected type-but not modifier-discordants. Specifically, it is now apparent that these children,whilst clearly not behaving in a thoroughly mature fashion were nevertheless making mature judgements to the extent that correspondence with regard to type-defining values was generally adjudged to be more important than correspondence with regard to the type-modifying values.

CHAPTER 4: FURTHER STUDIES OF PRESCHOOL CHILDREN'S CORRESPONDENCE JUDGEMENTS - WITH SPECIAL REFERENCE TO THE INFLUENCE OF LINGUISTIC FACTORS

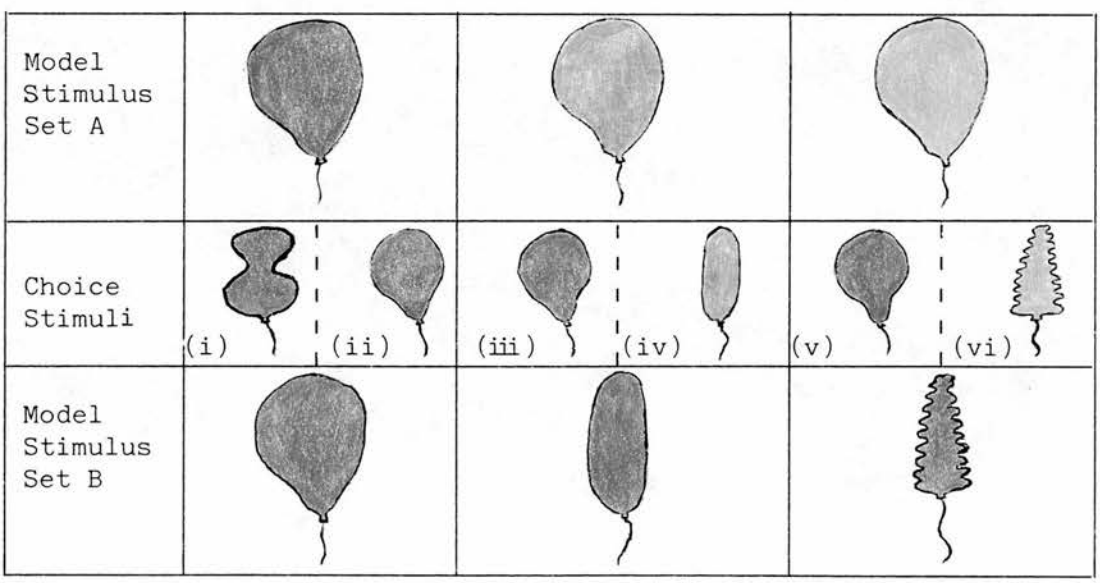
4.1 Introduction to the issues to be investigated

It has been previously reported that whilst preschool children prefer to base spontaneous groupings of representational material upon type-defining values rather than type-modifying values (cf., Section 3.2), comparable preschoolers will, when judging the adequacy of pictures on correspondence tasks cast in the form of shopping games, tolerate certain type-discordant pairings (cf. eg., Section 2.3). One explanation for the readiness with which these type-discordances were tolerated is that subjects were responding as a function of the informational constraints of the task; specifically, there was evidence that young children require only that the correspondents should not be misleading as to the type of the model (cf., Section 2.3.3). The present chapter reports two studies, each of which was in some way concerned with preschool children's sensitivity to some of the informational constraints which may be placed upon correspondence judgements when the shopping format is employed. Each of these studies used a choice-preference procedure; these procedures were similar to those utilised in Studies Three and Four (cf., Sections 3.2 and 3.3, respectively).

The first of the present studies (reported in Section 4.2) is concerned with the importance which young children attach to correspondence with regard to type name relative to visual-perceptual and functional correspondence, respectively. The method adopted was to present a series of model objects in which function and appearance are separable and to require subjects to choose, for each model, between a perceptual correspondent which was functionally discordant and a functional correspondent which was perceptually discordant. The object and picture sets were selected so that the type names by which the members of each pair of 'correspondents' offered could be legitimately called, varied systematically for each model object. By using such a method it was possible to examine the extent to which children prefer type-name correspondence to perceptual or functional correspondence per se. This issue is significant in a number of respects. In particular, the relative prominence of perceptual and functional factors in childrens' concepts has been much debated in the last decade, most notably by Eve Clark on the one hand and by Katherine Nelson and Jeremy Anglin respectively, on the other (cf., Section 1.3). In the present view, however, it is emphasised that names are of greater informational significance than either perceptual or functional cues because only they encompass the various bases (perceptual and/or functional) inherent in different concepts (see also, Section 1.3).

The second of the present studies (reported in Section 4.3) is concerned with how the context in which model objects appear, influences the dimensional correspondences which preschool children prefer. Consider, by way of example, the two sets of model objects and the choice pictures (two for each model) featured in Figure 15. It is evident that if subjects were to be given the task of choosing, for each set of models, the choice stimuli which will permit the set members to be accurately distinguished then the appropriate choices would be stimuli (i), (iv) and (vi) respectively for the

Figure 15 Illustration of how, for a given model stimulus, the informational value of correspondence with regard to colour and shape respectively depends on the stimulus context in which the model appears (see text for details).



three models in Set A and stimuli (ii), (iv) and (vi) respectively for the model stimuli in Set B. In other words, subjects who are sensitive to the informational constraints of the task should judge it to be more important to maintain correspondence for dimensional values with respect to which the set members vary than to maintain correspondence with regard to a dimensional value which is possessed by all the set members. It is apparent that there is a sense in which this kind of task requires that the properties of the models be treated rather more arbitrarily than is necessary in the relatively straightforward correspondence tasks previously presented (cf., Sections 2.2 and 2.3 respectively). That is, in the present task, subjects are required - even for the same model - to value shape and colour correspondence differentially according to the composition of the object set in which the model appears; notice in this regard that in Figure 15, although the first model stimulus in Set A is the same as the first model in Set B, a different choice stimulus should be chosen for each. The kind of ability tapped by the present task has, potentially, a considerable bearing on the issue as to whether preschool children can reclassify a set of objects by a second grouping criterion. As has previously been noted (cf., Section 1.3) it is traditionally assumed that young children cannot perform such reclassifications. Of considerable relevance to this study is the suggestion made in relation to the findings of Study Three (cf., Section 3.2) that young children will reclassify material when they are provided with a sound reason for so doing. It is a characteristic of traditional classification tasks that genuine reasons for making reclassifications are rarely, if ever, provided. By casting the present task in the form of the shopping game however, subjects are provided with a genuine motive for making reclassifications.

One variable which may have an important influence upon young children's ability to reclassify material of the kind illustrated in Figure 15 is whether or not the modifying values distinguishing the set members are articulated. In this regard, one point which arises from the work of Olson (1970; cf., Section 2.3.3) is that the modifiers given in Studies One and Two (reported in Sections 2.2 and 2.3, respectively) were to a large degree superfluous given the contexts in which the objects appeared. That is, for subjects to have required correspondence with regard to the modifying values in these studies would not have in any way aided the differential coding of the objects since unambiguity as to type was all that was required for this. It may be then that there is an informationally-based reason why subjects did not always respond to the modifiers when they were given in these experiments. On sets such as those shown in Figure 15 however, the appropriate modifiers (ie., 'red', 'green' and 'yellow' and 'round', 'long' and 'squiggly' respectively) refer to values which are of critical importance so far as the differential coding of the objects is concerned. Study Six therefore investigates whether or not the giving of appropriate modifiers does influence young children's correspondence preferences for this kind of object set.

4.2 Study Five: A study of the relative value placed by preschool children upon nominal correspondence and upon perceptual and functional correspondence respectively

4.2.1 Introduction

One contrast which is often made in the literature on concept acquisition within the literature on language acquisition (cf., eg., Bowerman, 1977) is between the 'Semantic Feature' theory of Eve Clark - which stresses the role that the perceptual characteristics of objects play in concept formation - and the 'Relational Concept' theory which has been most recently propounded by Katherine Nelson (see also, Anglin, 1977) and which emphasises the role of functional cues in concept formation. It should be stressed that the present study is not so much concerned with the psychological bases involved in the process of concept acquisition as with the bases of concepts which young children have already acquired. However, it does seem likely that these theorists' different emphases upon the relative importance of perceptual and functional cues in concept acquisition are reflected, to some extent at least, in these theorists' views of the bases of established concepts. Thus, although Nelson (eg., 1974) suggests that concepts are generalised on the basis of perceptual cues, she does contend that the critical core of concepts remains the functional component. It should be noted however that Clark does recognise that functional properties may dominate perceptual properties later on in development. Thus she observes:

> "Later on, obviously, the function of an object may prove to be as important (or even more important than) its perceptual characteristics in deciding what it should be called in a particular situation in a particular culture (Clark, 1974 p. 109)."

Concerning the role of language in conceptual development, Clark has always stressed the important role played by linguistic factors but Nelson has been reluctant to do so (cf., Section 1.3). Interestingly, however, more recently Nelson (eg., Nelson, Rescorla, Gruendel and Benedict, 1978) has admitted that her earlier assumption that words are matched to pre-formed concepts requires modification; moreover she has noted that,

> "in certain cases, the process of conceptualisation can be viewed directly by tracing the labeling progression (Nelson et al., op. cit. p. 962)."[1]

These more recent remarks by Nelson et al. are significant because they indicate that Nelson does now emphasise that young children may attach considerable importance to what an object is called. It is unclear however whether Nelson would suppose young children to attach more importance to nominal correspondence than to functional correspondence. Similarly, it is unclear whether Clark would suppose young children to attach more importance to nominal correspondence than to perceptual correspondence. In the present view (cf., Section 1.3) it is held that the relative primacy of perceptual and functional elements in people's concepts of objects, varies greatly according to the kind of object, and it is contended that children will therefore soon learn to value the names by which objects are called as of even greater categorial significance (although in practice, concepts of objects will always, of course, be underwritten by perceptual and/or functional features). Specifically then, the present hypothesis is that young children will, in an object-coding task, attach more importance to the type-name by which an object is called than to what the object looks like or to what the object does and how it is customarily acted upon.[2]

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(1) It should be noted that in the same article, Nelson et al. go out of their way to stress that 'their' view had always been that from about 1:6 or so, children may begin to form concepts directly from words.

(2) N.B. The hypothesis that young children will value type-name correspondence more than intrinsic perceptual correspondence is consistent with the finding of Study Two (cf., Section 2.3) that preschoolers did not tolerate pictures of models which could not reasonably be given the same type-name as the models but did tolerate pictures which could legitimately be given the same type-name as the model even if these pictures were discordant with regard to <u>both</u> shape and colour.

4.2.2 Method

4.2.2 (a) Subjects

Twenty-four preschoolers participated in the study. These were the same children as took part in Study Three (cf., Section 3.2.2 (a)). Each S participated in Study Three before the present study. The mean interval between the two sessions was 6.7 days (range 4-13 days).

4.2.2 (b) Materials

These were 3 model objects and 6 choice objects plus 3 boxes, a teddy bear in a high-chair and a toy cash-register. The boxes, teddy and cash-register were identical to those used in Studies One and Two. The model objects (cf., Table 11 column one) were an orange, a candle, which looked like an apple and a pen disguised as a lollipop in which the lolly 'head' functioned as the pen cap. There were 2 choice-objects for each model object. For the orange (cf., Table 11; row one-p.124) the choice-objects were a plastic orange and a sandwich (wrapped in cling film); for the apple-like candle (cf., Table 11; row two) the choice-objects were a real apple and an ordinary candle; and for the pen disguised as a lollipop (cf., Table 11; row three) the choice-objects were a real lollipop and a normal pen. For each model object then, Ss were offered a choice between an object which was in visual-perceptual terms virtually identical (corresponding with regard to colour, shape, size and texture) and an object which was functionally very similar but visually-perceptually very different.

4.2.2 (c) Design and procedure

Table 11; column one indicates the names by which the model objects were described. It is apparent that the linguistic correspondence of the choice-objects varies systematically between the different models. Thus, in the case of the model orange, the perceptual but not the functional correspondent may be legitimately described with the same type name. In the case of the model candle, the functional but not the perceptual correspondent may be referred to with the same type name. Whilst, in the case of the 'lollipop-pen' the perceptual and the functional correspondents may each be legitimately referred to by one only of the two components of the name given (ie., 'lollipop' and 'pen' respectively). The rationale then was that if Ss do judge linguistic correspondence to be more important than either perceptual or functional correspondence per se then, in the case of the model orange their preference should be for the perceptual correspondent; in the case of the model candle their preference should be for the functional correspondent whilst, in the case of the model 'lollipop-pen' their choices should be split more or less equally between the perceptual and the functional correspondents. Alternatively, if Ss consider that either perceptual or functional correspondence is more important than linguistic correspondence then they will opt to maintain perceptual or functional correspondence independently of the other correspondence bases.

It is evident from the previous section that the choice-stimuli were objects rather than pictures. Choice-objects were preferred to choice-pictures because objects permit the full force of functional cues to be operative whereas pictures do not.

There were no experimental subconditions in the study. Each S therefore received the same procedure. This procedure resembled that used for Studies One and Two. Ss were first shown the shopping till and the teddy and it was then explained that the teddy was going to 'run a little shop'. The 3 model objects were then presented; the order in which these objects were presented was counterbalanced between Ss. It was explained that these objects were to be sold in the shop and as each one was introduced it was named as an 'orange', a 'candle' or a 'lollipop-pen' (as appropriate). After each model was named, Ss were asked:

> "What do you do with a ___________ (ie., the appropriate type name) like this?"

This question was asked to help ensure that each child was aware that the orange was a real orange, that the candle could actually burn and that the lollipop-pen could be used to write with. To make quite certain that these functions were fully understood, the E actually lit the candle for a few seconds and used the lollipop-pen to draw some lines with. The 3 boxes were then introduced with the same routine as that employed in Studies One and Two for the physical object presentations (cf., Section 2.2.2 (d) i) and similarly, the suggestion was made that,

> "We could put something onto the boxes to help the teddy remember what's inside the boxes."

The E then selected the box containing the object which the S was to be presented with first and, opening it up, asked the S "What's in here?" If a S failed to use the correct name (that is, the name given previously to that object by the E), the E corrected the mistake. For example, if the S named the model candle as an apple, the E said:

> "Actually it's not an apple is it? Because, do you remember - it burns doesn't it? So really it's a candle."

The 2 choice-objects for the model object being presented were then placed, simultaneously, in front of the S, side-by-side (the relative position of the members of each pair of choice-objects - ie., left or right - was counterbalanced between Ss). The E then said: "Well, we have two things we could put on the box" and the 2 choice-objects were named. The names used were: 'a plastic orange'(3) and 'a sandwich' or 'an apple' and 'a candle' or 'a lollipop' and 'a pen'. The critical question then asked was:

> "So which one (the E indicating the 2 choice-objects) should we put on to show that there's a ___________ (ie., predesignated name for the model) inside the box?"

After the choices for each of the 3 models had been made, Ss were asked to justify the first of the choices they had made. The question used was: "Why did you choose that one to go on the box?" Ss were then asked whether the choice-object which had not been selected could have been legitimately used. The words used here were:

> "Could we have put that one on (ie., indicating the choice-object which was not chosen)? Would this have shown what is inside?"

These two sets of questions were then repeated in relation to the second and third object choices respectively. It should be noted that these questions were not asked until this late stage because it was considered that if they had been asked directly after the relevant object choices then the process of answering them might have influenced the children's subsequent object selections.

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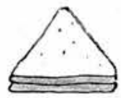
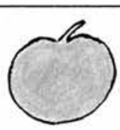
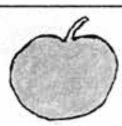
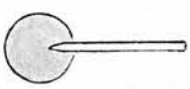
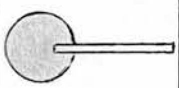
(3) N.B. Ss were encouraged to handle and, in particular to depress this choice-object.

4.2.3 Analysis of results

The main question of interest concerns the number of choices that were made for the perceptual and functional correspondents respectively, for each of the model objects. Table 11 (cf., data columns one and three) gives the pertinent figures. It is apparent that the pattern of correspondence preferences varies considerably

Table 11 Breakdown of the proportion of children choosing and accepting respectively the perceptual and functional correspondents offered for each model object.(1)

Model Objects (with names given)	Choice Objects (with names given)		No. of $\underline{S}$s choosing perceptual correspondents and percentage of these $\underline{S}$s accepting functional correspondents		No. of $\underline{S}$s choosing functional corrpondents and percentage of these $\underline{S}$s accepting perceptual correspondents	
	perceptual correspondents	functional correspondents	Nos.	Percents.	Nos.	Percents.
 orange	 plastic orange	 sandwich	21	14%	2	100%
 candle	 apple	 candle	3	33.3%	20	50%
 lollipop-pen	 lollipop	 pen	16	75%	7	86%

(1) One $\underline{S}$ has been omitted from these analyses on the grounds that she changed her object-choices repeatedly.

between the different models; more importantly however, these variations are mainly in accordance with the preference shifts anticipated. Specifically, for the model orange, the preference is for the perceptual correspondent rather than the functional correspondent (applying χ^2 for 1-sample case, $p \angle 0.001$); for the model candle on the other hand, the preference is for the functional correspondent rather than the perceptual correspondent (applying χ^2 for 1-sample case, $p \angle 0.001$); whilst, for the model lollipop-pen, although there is a preference for the perceptual correspondent relative to the functional correspondent this preference is not as strong as those arising in relation to the other models (applying χ^2 for 1-sample case, $p < 0.1$; approaching 0.05). Taken together, these results do tend to suggest that the main influence upon the children's correspondence preferences was the names by which the stimuli can be legitimately called rather than perceptual or functional correspondences per se. However, the results for the 'lollipop-pen' model do imply that Ss nevertheless had a slight general tendency to prefer perceptual correspondents to functional correspondents. One possible explanation for this latter finding is that the perceptual correspondent may be preferred in this case merely because the 'lollipop' component of the model name is, by virtue of its greater number of syllables, more prominent than the 'pen' component. There is however, another line of evidence which does suggest that Ss did indeed find the perceptual correspondents to be slightly more generally acceptable than the functional correspondents. This second line of evidence derives from the children's judgements as to whether the correspondents which they did not actually choose were, nevertheless, acceptable correspondents. As Table 11 shows (cf., data columns two and four), for each model, those Ss who selected the functional correspondents were more likely to accept the perceptual correspondents than those Ss who chose the perceptual correspondents were to accept the functional correspondents.

It should nevertheless be emphasised that, so far as correspondence preferences were concerned, the results suggest that the primary influence upon the children's judgements was whether or not the correspondents could be legitimately called by the same name as the model. Specifically, when offered the choice between a full linguistic correspondent[(4)] and a perceptual correspondent merely or else a choice between a full linguistic correspondent and a functional correspondent merely, Ss tended to opt, in each case, for the linguistic correspondent. The view that linguistic correspondence was the primary factor determining the children's correspondence preferences is confirmed by the justifications which Ss gave

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(4) N.B. In the case of the 'lollipop-pen' model, neither choice-object had a name which corresponded in full to the name of the model.

for their choices. Thus, of those 21 Ss who chose the plastic orange for the orange model, 19 Ss justified this choice explicitly in terms of the linguistic correspondence - for example:

> " 'cause they're both oranges. ' cause they're both the same."

Similarly, of those 20 Ss who chose the candle for the candle model, 13 Ss justified their choice explicitly in linguistic terms - for example: "' cause that's a candle too."(5)

4.2.4 Discussion

This study found that subjects preferred the correspondents with the same type name independently of visual- perceptual or functional correspondence per se. It should be emphasised, however, that this study did not investigate whether subjects' preference for the linguistic correspondents was independent of both perceptual and functional correspondence simultaneously(6) (since the linguistic correspondents offered always corresponded to the model, either perceptually or functionally). What this study shows, then, is that linguistic correspondence underwritten by either perceptual or functional correspondence is systematically preferred by young children to either perceptual or functional correspondence alone. It should be noted however that the study did not take account of extrinsic perceptual cues. Specifically, the perceptual correspondences operative were invariably intrinsic only whilst the functional correspondences were both intrinsic and extrinsic (cf., Section 1.3 for definitions of these terms). There was one additional finding. Specifically, there was some limited evidence that overall, subjects marginally preferred perceptual correspondence to functional correspondence. The most suggestive evidence in this regard was that subjects were generally more willing to accept perceptual

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(5) Interestingly, there was also some limited evidence that the younger the child the more likely it is that the functional correspondent will be chosen in preference to the perceptual correspondent. Specifically, whereas the mean age of children choosing the pen, the sandwich and the candle options was 3:10, 3:8 and 3:10 years respectively, the mean age of the children choosing the lollipop, orange and apple options was 4:0, 4:0 and 4:7 years respectively.

(6) Indeed to carry out such a comparison for natural objects would appear to be impossible though it would of course be possible to use perceptual correspondences other than visual ones.

correspondents which they had not chosen than they were to accept functional correspondents which they had not chosen. This effect was most pronounced in respect of the orange model, concerning which, very few of the large number of subjects who chose the perceptual correspondent considered that the functional correspondent was also acceptable. One point which should be borne in mind when reflecting upon this latter finding is that the functional correspondence between orange and sandwich (a sandwich being the functional correspondent) occurs at a higher level of nominal abstraction - that is, 'food' - than the functional correspondences operative in the cases of the model candle and the choice-candle, and the model lollipop-pen and the choice-pen. It may be then that the strong preference displayed by subjects for the perceptual correspondent relative to the functional correspondent for the orange model was partially elicited by the functional correspondence having occurred at a higher level of nominal abstraction than that of type.(7) Because, however, there was also some limited evidence that subjects preferred the perceptual correspondent to the functional correspondent for the lollipop-pen model (cf., Section 4.2.3) it does seem likely that there was a slight tendency for subjects to find the perceptual correspondents more generally acceptable than the functional correspondents.

One critical issue in interpreting the main result that subjects preferred the linguistic correspondents, independently of perceptual or functional correspondence per se concerns the extent to which subjects' choices were made with a view to satisfying the informational requirements of the task and the extent to which this result has more general implications concerning the nature of young children's concepts of everyday objects. It is apparent that the finding itself is thoroughly consistent with the type hypothesis; that is, for those two models for which they were given the choice, subjects opted for the type-correspondents in preference to the type-discordants. Whereas however, previous studies showed only

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(7) One method of avoiding this discrepancy would have been to have presented, instead of a model orange, a further object with a disguised functional identity and to call it by the type name of its perceptual features (eg., present a chocolate 'motor-car' and call it 'a car').

that preschool children prefer type-correspondents to type-discordants independently of shape and/or colour correspondence per se, the present study indicates that the relative preference for type-correspondents may be independent of visual-perceptual or functional correspondence per se. As intimated above, there are two levels at which this finding may be explained. At the first level, it is evident that, for the orange and candle models, subjects opted for the choice-objects which represented the type of the model unambiguously in preference to choice-objects which were clearly misleading as to the type of their respective models (ie., the sandwich and apple choice-objects). This finding directly parallels the conclusion made in relation to the results obtained in Studies One and Two that, young children will tolerate discordants which maintain type unambiguously but will not tolerate discordants which are misleading as to type. It may therefore be that, in the present study, subjects deliberately chose the correspondents which ensured that the box contents were accurately and differentially encoded at the type-level. There is however, a second level at which the main finding may be explained. Specifically, the results of Study Three (cf., Section 3.2) indicated clearly that, in circumstances where there were no informational constraints at all, preschool children's preferences were for type-based groupings rather than cross-type groupings. It may be, therefore, that subjects' correspondence preferences in the present task were not specifically elicited by the informational constraints of the task but are rather, merely reflective of subjects' spontaneous correspondence preferences. Nevertheless, these two levels of explanation are not incompatible. It is noteworthy in this regard that it is possible to argue that the finding that preschool children prefer to make type-concordant groupings rather than purely dimensional groupings on an unstructured grouping task (cf., Section 3.2), suggests that those (comparable) children who tolerated non-type-misleading type-discordants (such as the blue giraffe) on correspondence requirements tasks (cf., Section 2.3) did so because they recognised that these correspondents were informationally adequate. Thus, in the present task, subjects may have been conscious of the informational advantages of choosing the type-correspondents and may also have been choosing the correspondents which accord most closely with their conceptual representations of the model objects.

It cannot however be determined with any certainty whether subjects in the present study were consciously sensitive to the informational constraints of the task.[8] The present results do though appear to have some implications concerning the nature of children's concepts of objects. To be sure it may be that the informational constraints of the shopping game did influence subjects' choice of correspondents by causing them to place more value on linguistic correspondence than they might have done in other circumstances. Nevertheless, the present choice-preference task would, even with this constraint, seem to have some status as a conceptual task. The correspondence judgements were always made between objects (ie., rather than between pictures and objects - which may have a wholly different kind of relationship, cf., Section 1.4.2) and the informational constraints of the shopping format would not seem to divert subjects overmuch from choosing the choice-stimuli which they would, in informationally neutral circumstances have judged to be 'most similar' (cf., Section 1.4.4). In addition to this the range of possible conceptual tasks similar to the present one is wide and since it seems likely that the relative importance of linguistic, perceptual and functional elements will show some variation as a function of the particular circumstances of the correspondence judgements it would seem to make little sense to think of these elements as being in a fixed hierarchy of importance independently of these circumstances. Thus the main significance of the present study is that it demonstrates that, in the present task at least, linguistic correspondences determine whether perceptual or functional correspondents are most valued by young children. This conclusion emphasises that an adequate theory of conceptual development must allow for the rapid development of attention to linguistic factors and highlights the weakness of accounts of conceptual

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(8) It had been hoped that the justifications subjects gave for their choices would have been rather more revealing as to the degree to which subjects were conscious of these constraints than they were. Specifically, although justifying the choice of type-discordants predominantly in linguistic terms (ie., rather than in terms of the underlying perceptual or functional correspondence) subjects' justifications disclosed virtually nothing about their consciousness of informational constraints. The justifications obtained in the following study (cf., Section 4.3) are rather more revealing in this respect.

development which put too much stress on either perceptual or functional elements alone. The present findings would seem also to add some empirical weight to the arguments made previously (cf., Section 1.3) that the correlational structure in natural categories between perceptual and functional bases is less than Rosch suggests.[9] This study supports then the present emphasis that young children are sensitive to a variety of different psychological bases in which natural concepts would appear to be grounded and indicates, in particular, that these bases may include functional bases. Interestingly, these conclusions accord with Bowerman's (1977) conclusion - based upon the spontaneous speech of her own children - that young children, from an early age, recognise constancies on the basis of a wide variety of perceptual, functional and other similarities and that an adequate theory of the acquisition of word meaning (and, it might be added, conceptual development in general) must be flexible enough to account for these diverse abilities.

4.3 Study Six: A study of the influence of the context in which model objects appear upon preschool children's correspondence preferences

4.3.1 Introduction

It has been observed above in relation to the studies using object coding tasks that the performance of the children tested does indicate that young children display a preference for preserving unambiguity as to type name in the model correspondents. The pertinent results concern the correspondence requirements preschoolers made for shape and/or colour correspondence respectively (cf., Section 2.3) and the correspondence preference judgements preschoolers made between perceptual and functional correspondents (cf., Section 4.2). One interpretation of these correspondence judgements is that subjects consciously responded as a function of the informational constraints of the task, that is, subjects required or preferred the correspondents which permitted the objects to be differentially encoded, unambiguously, at the type level. Alternatively however,

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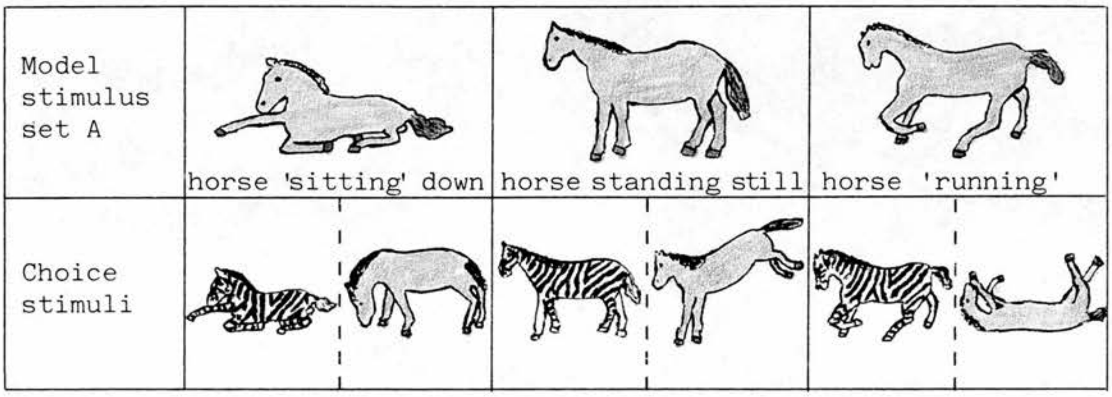
[9] It should be remembered though that because Rosch describes functional cues exclusively in terms of motor movements (cf., Section 1.3), she omits to consider the role of intrinsic functional cues.

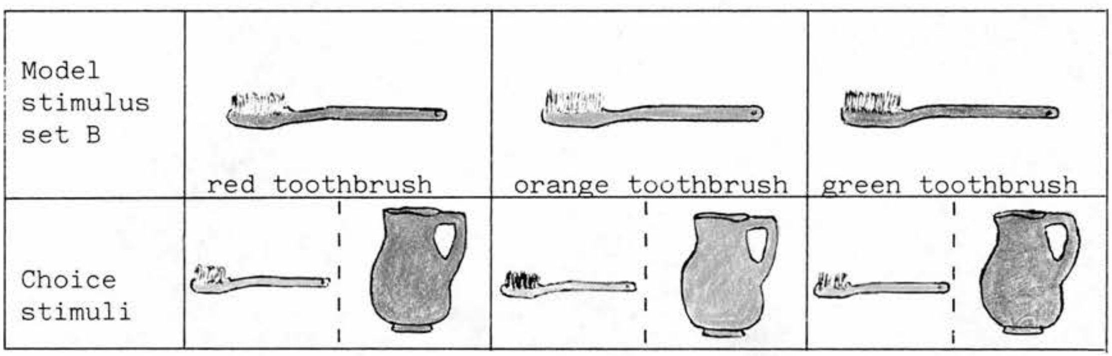
it may be that subjects were not actually aware of the informational consequences of their choices but that their requirements or preferences for the non-type-misleading correspondents simply reflected their spontaneous correspondence judgements.

The present study is expressly concerned with whether preschool children are sensitive to the informational requirements of object coding tasks, independently of their evident spontaneous preference for type-correspondents (for evidence of the latter, see Section 3.2). The basic method which it is proposed to use to do this has been previously introduced. Specifically, if children are given the task of differentially encoding sets of models such as those shown in Figure 15 (p.117) then they should, if they are genuinely sensitive to the informational demands of the task, systematically prefer correspondence with regard to the dimensional values distinguishing the set members to correspondence with regard to the fixed dimensional value characterising each of the set members. It is apparent however, that the arrays shown in Figure 15 do not permit subjects' sensitivity to the informational requirements of object coding tasks to be determined independently of their preference for type-correspondents relative to type-discordants. To achieve this it is necessary to use sets of models such as those shown in Figure 16; specifically, with sets of models such as these, systematic sensitivity to the informational demands of the task would be evidenced by the choice of correspondence with regard to the type-modifying values in preference to correspondence with regard to the (fixed) type-defining value (that is, in Figure 16, a preference for shape correspondence in the case of Set A and a preference for colour correspondence in the case of Set B).

It is apparent that the task presently being proposed requires that the choice-stimuli (and in particular, the modifier-concordants) be used much more in the role of symbols than of 'faithful' representations of the models. It should however be emphasised in this regard that, strictly speaking, none of the choice-stimuli illustrated in Figure 16 are genuine symbols because they each bear some physical relationship to the relevant referents (that is, they are not completely arbitrary).[10] Nevertheless the modifier-concordants in particular, clearly possess certain symbolic qualities and although

<u>Figure 16</u> Two sets of models in which the type-modifying values carry more information than the type-defining values.





they are not genuine symbols it does seem that if young children presented with sets such as those shown in Figure 16 were to evidence a preference for the modifier-concordants relative to the type-concordants, this result would have certain implications concerning young children's ability to use more symbolic forms of external representation. It is noteworthy in this regard that there is little debate concerning young children's ability to <u>use</u> arbitrary codes since children readily use words orally. Rather, a more

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(10) N.B. It should be noted that in Piagetian terminology, (cf., Berlyne 1964; Flavell 1963), symbols as so defined are called signs whilst the term 'symbol' is used to refer to signifiers which are adjudged to have some physical similarity to the referent (eg., the image signifiers evoked in symbolic or fantasy play and deferred imitation).

fundamental question would seem to be (cf., Section 1.3) whether young children can use such codes in a conscious and deliberate fashion whilst being fully aware of their arbitrary status. This question is not easily researched but the present task does seem likely to yield some pertinent results.

The proposal that more information is carried by the type-modifying values than the type-defining values in object sets such as those illustrated in Figure 16 is very much related to the use of information concepts by information theorists. These theorists (eg., Garner, 1962) emphasise that the amount of information obtained from any event or act of communication is not so much a function of what does happen but is rather a function of what could have happened but didn't. In Garner's terms, information is technically defined on the basis of the amount by which some a priori uncertainty has been reduced. It is not difficult to see that on object coding tasks requiring the differential encoding of objects such as those shown in Figure 16, the dimensional values which it is critical to communicate from an informational point of view are the type-modifying values. The present task therefore requires not only that subjects should consciously employ more symbolic forms of thought (cf., above) but also that this thought should be directed to satisfying an external informational constraint.

It is interesting to consider at this point some of the features of the approach to semantics outlined by Olson (1970). Olson rejects purely linguistic theories of semantics which look at word meaning in terms of other words and argues that a semantic theory requires that the language user's non-linguistic knowledge be considered. Olson's argument rests on showing that word choice is not merely a function of either syntactic or semantic selection restrictions but involves the speaker's knowledge of the referents (ie., the objects and events which words refer to). Olson stresses that no single description can describe facts as they really are and that therefore, words always direct attention to specific meanings and, in particular, he emphasises, like Garner, that the informational value of a given communication depends upon the nature of the alternatives being compared or considered. One example Olson gives (op. cit.) concerns the varying descriptions which people will use to refer to a round white block, one inch in diameter. Thus, if this object has to be distinguished from an object identical in all respects except colour, it is likely to be referred to as 'the white one', if instead, the same object has to be distinguished from an object identical in all respects except shape, it is likely to be referred to as 'the round one' and so on. The relevance of Olson's remarks to the present task is clear; thus, in the object sets in Figure 16, the critical information is 'the one sitting down', 'the one standing still' etc.

The question arises as to the likelihood that young children's correspondence choices for model objects will reflect a sensitivity to the context of alternatives in which the models appear. It is noteworthy in this regard that young children do not perform well on referential communication tasks. In particular, Ford and Olson (1975) varied the contexts in which model stimuli appeared and studied how, if at all, young children given the task of describing the models, elaborated the noun phrase according to the contexts presented. Ford and Olson found that a group of children of mean age 5:5 years named object pairs differentially when they varied with regard to one feature. When however comparable children received larger object sets requiring more features to be mentioned, no differential labelling occurred, either for the large sets or for the single pair sets. Ford and Olson advance the explanation that the disappearance of the effect in such circumstances occurs because young children's descriptions -

> "reflect the contrasting alternatives in the situation as a whole, not the immediate context of alternatives (p.380)."

Furthermore, more generally, they postulate that-

> "from the outset, children's utterances reflect the descriptive function of differentiating an event from a set of perceived alternatives (p. 381)"

- but that because, to begin with, inferred alternatives are borne in mind as well as perceived alternatives, descriptions initially become increasingly independent of context and only come into line with the minimum redundancy hypothesis(11) at approximately fourteen-years of age.

Ford and Olson's study suggests then that young children are unable to describe model objects in such a way as to enable them to be discriminated from the immediate object context, unless only one differentiating value requires to be attended to. Now, in the kind

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(11) That is, the hypothesis that the noun phrase is only elaborated to the point at which the referent object can be differentiated from the alternatives immediately available (cf., Section 2.3.3).

of objects sets proposed for the present study (cf., Figure 16 for examples), subjects are only required to attend to differentiating values on a single dimension. It is apparent however, that the fundamental requirement of the present task is not the differential naming of the objects but rather the systematic selection of pictures concordant with regard to the type-modifying values and the systematic ignoring of pictures concordant with regard to the type-defining values. These picture selections require considerable skill in co-ordinating the shape and colour discordants. More importantly though, it has been previously demonstrated that, in circumstances where there are no informational constraints upon performance, both children and adults prefer correspondence with regard to type-defining values to correspondence with regard to type-modifying values (cf., Sections 3.2 and 3.3, respectively). Subjects might therefore be expected to find the ignoring of the type-defining value correspondents especially difficult. It may seem unlikely then that young children will perform well on the proposed task. Nevertheless, it may be significant that the present tasks do not place so much of a requirement upon subjects for the production of appropriate responses as the task studied by Ford and Olson (op. cit.). Specifically, whereas in Ford and Olson's task, subjects were required to produce the appropriate description themselves, in the present tasks the proposal is to present subjects with picture options from which they have only to recognise the informationally critical correspondents. This distinction between the two tasks may be significant since it has been reported by Chalmers and McGonigle (1979) that the main basis for young children's poor performance on referential communication tasks is their failure to generate satisfactory descriptions.[12]

The present study should at this point be outlined more precisely. The main question examined was whether preschool children's preferences for correspondence, with regard to type-defining and type-modifying values respectively, shifts for four critical object models (these models are illustrated in Figure 17,

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[12] N.B. Chalmers and McGonigle rule out the possibility that children's poor performance is attributable either to a lack of matching abilities or to a failure to comprehend specific verbal references.

p.140, and discussed below) according to whether these models are presented in a type-same context (ie., in which the objects presented are all of the same type) or a type-different context (ie., in which the objects presented are each of a different type). It was expected that when each critical object was presented in a type-different context, subjects would prefer the type-correspondents (these correspondents providing sufficient information to code the objects differentially). Concerning the presentation of each of the critical objects in a type-same context, it was expected that, for each critical object, subjects would be more likely than for the type-different contexts to choose the type-modifier concordants; however, as indicated above, the probable strength of these shifts was not at all clear.

In considering the likelihood that children's preferences for type-correspondents relative to modifier-correspondents will be sensitive to the context in which the models appear, two factors emerged which, it seemed possible, might have a bearing upon the results obtained. The first of these is the manner in which members of the object sets are presented. In this regard it has been commented by Olson (1970) that pictures (or objects) are more informationally ambiguous than words because whereas in the case of physical stimuli,

> "you don't know whether to attend its color, size, style, state of repair and so on (p.265)," -

words possess a much more specific meaning. Olson then (like Luria - cf., Section 2.1), considers that what is perceived may be restructured by language. These remarks indicate then that in the present task the description of the model objects with relevant modifiers should increase the attention which subjects pay to correspondence on the modifying values. It is however a fundamental requirement in the present study that any description given to the critical objects be used to describe these objects in <u>both</u> the type-same and the type-different contexts since only if this is the case can any shifts in correspondence preferences be reasonably attributed to subjects' sensitivity to the informational demands of the task. It is noteworthy in this regard that the citing of relevant modifiers <u>may</u> cause subjects to prefer the modifier-concordants independently of the context in which the objects occur. The present study was therefore very much exploratory in character. Accordingly, subjects' correspondence preferences were examined in relation to three object presentation conditions. In the first presentation condition (abbreviated 'P') the model objects were presented physically but the experimenter did not describe them; in the second presentation condition (abbreviated 'P-T-M') the objects were both presented physically and described with a type name plus a relevant modifier and; in the third condition (abbreviated 'T-M') the objects were described with a type name plus a relevant modifier but were not physically presented.

As previously indicated, no clear-cut predictions were made concerning whether preschoolers' correspondence preferences would be affected by the contexts in which the models appeared. It was anticipated however that subjects' sensitivity to contextual factors would be maximised in those conditions in which modifiers were given.[13] In particular it was considered that the P-T-M presentation condition might provide the optimum conditions for enabling young children to shift their correspondence preferences according to object context. The reason for thinking this derives from the finding of Study Two (cf., Section 2.3) that a P-T-M presentation condition failed to deter preschoolers from accepting modifier-discordants but did at least produce widespread rejections of the type-misleading type-discordants. Since the objects presented occurred in a type-different set, this finding clearly suggests that in the present task, type-correspondents will be preferred to type-misleading type-discordants so far as type-different sets are concerned. The interpretation given to the Study Two finding was that for a type-different set of objects, type differences were the most salient differences and that since the modifiers were superfluous in informational terms, the modifiers merely set up an attentional conflict which most subjects eventually discounted (cf., Section 2.3.3). By contrast however, in the case of same-type object sets, the salient differences between the stimuli are differences in

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(13) It might be thought that there is little reason to suppose that shifts according to object context may be facilitated by giving labels which refer to both the type-defining and the type-modifying values (that is, on the basis that the effects of the two words will cancel 'each other' out). It should be noted however that since young children spontaneously name objects at the type-level anyway (cf., Section 2.2.3 (b) i), the net effect of noun phrase descriptions will be to place a relative emphasis on the modifying-values.

modifying-values and, most importantly, the modifiers reinforce these differences.

Besides examining the effect upon subjects' correspondence preferences of the manner of object presentation, a second potential influence was investigated in the present study. This second variable concerns the kind of type-discordant (and therefore modifier-concordant) pictures offered. Specifically, the question investigated concerns whether subjects' sensitivity to the composition of the object sets is influenced by whether the type-discordants represent identities of a clearly different type to the model (eg., for a red toothbrush, a red jug) rather than less blatant type-discordants (eg., for the red toothbrush, a red 'splash' of colour instead). The view that this factor may be significant derives from the previous finding (cf., Section 2.3.3) that preschool children are particularly unwilling to accept pictures of objects which represent identities of a different type (presumably because they would then be giving blatantly misleading information). It was considered therefore that young children might be more inclined to choose the type-discordants on the type-same sets if the type-discordants were relatively neutral as to type than if the type-discordants were more blatantly type-misleading. Additionally (and fundamentally) it was anticipated that young children would not prefer the more neutral type-discordants to the type-concordants on the type-different sets. Those type-same sets presented to subjects in the present study in which the type-discordants represented identities of a blatantly different type have already been illustrated (cf., Figure 16). In one of these sets the type-defining value is colour and in the other the type-defining value is shape. The type-same sets presented in the study in which the type-discordants offered were considered to be type-neutral are reproduced (together with all the other object sets presented) in Figure 17. The pertinent sets are that of the three biscuits (for which colour is the type-defining value) and that of the three combs (for which shape is the type-defining value). Concerning the selection of the biscuit set it should be noted that objects which occur in geometric shapes would seem to be one of the few cases where the shape can remain unchanged and yet the picture be neutral (ie., ambiguous) as to type when the colour is changed. (The reason why such stimuli are ambiguous is of course that many different objects occur in geometric forms.)

4.3.2 Method

4.3.2 (a) Subjects

Seventy-two children, 36 boys and 36 girls (mean age 4:1 years; age range 3:2 - 4:11 years) took part in the study. Each child was in attendance at one of two nursery schools in Edinburgh.

4.3.2 (b) Materials

Fourteen objects were arranged into 6 sets of 3 objects each. This arrangement was possible because 4 critical objects - the red toothbrush, the round biscuit, the yellow comb and the horse 'sitting down' - each occurred once in a type-same set and once in a type-different set. Of the remaining objects, 8 occurred in the 4 type-same sets (2 in each set) and another 2 objects were used to make the total number of objects in each of the 2 type-different sets up to 3. Details of the composition of the object sets and of the visual features of each object are given in Figure 17.

Twenty-eight pictures were used - there were 2 pictures (one shape discordant and one colour discordant) for each of the fourteen objects. Each picture set was presented on a separate picture mount (see Figure 17 for a sample arrangement of each picture set).(14) The picture mounts had a separate, vertical flap (opaque(15)) for each of the 3 picture pairs.

The E sat opposite each S at a child-sized table which was covered with plain white paper. A large doll with a toy cash-register 'to hand' sat next to the E. The only other materials used were 9 white cardboard boxes (that is, 3 sets of 3 identical boxes each) and a large toy lorry.

4.3.2 (c) Design

Figure 18 summarises the overall design of the study. The 72 Ss were divided into 3 groups of 24 Ss each; each of these 3 groups constituted one of the 3 object presentation conditions (ie., P,

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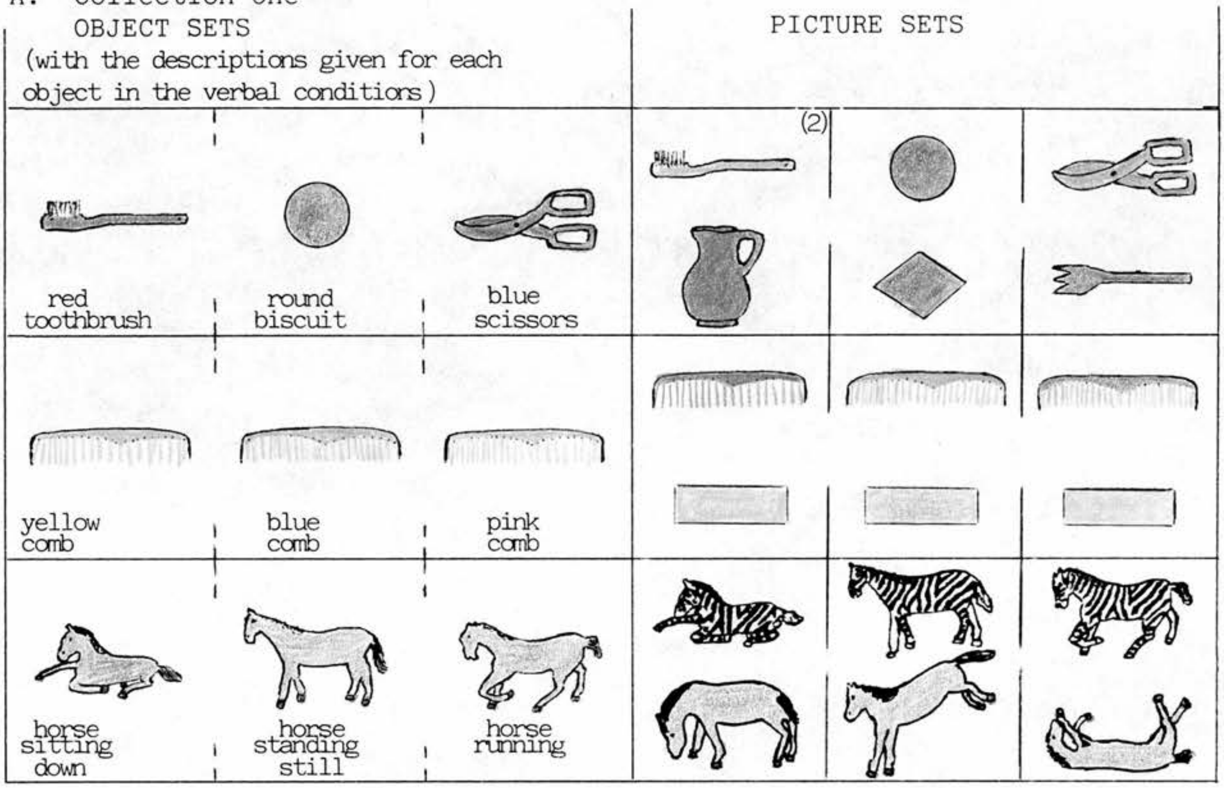
(14) Details of the constraints placed upon the picture positions are given in Section 4.3.2 (c).

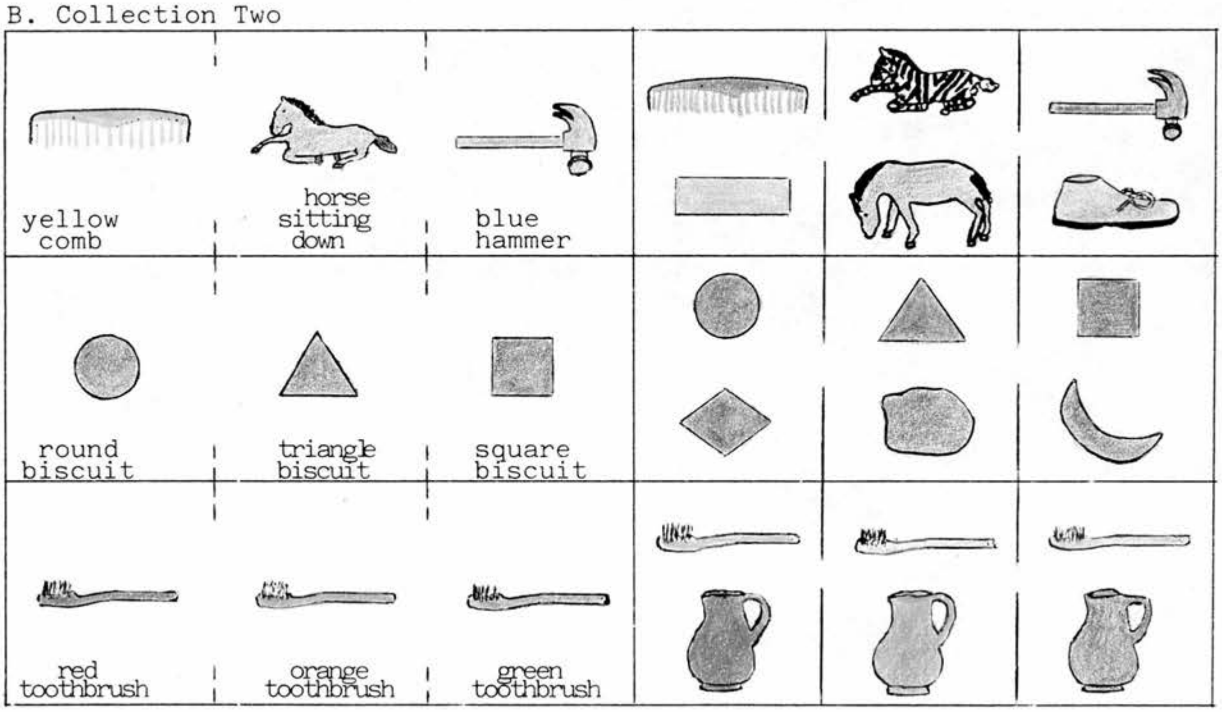
(15) N.B. The picture flaps used in the studies reported in this thesis were all opaque.

Figure 17 Object and picture sets used on Study Six.

A. Collection One[(1)]



B. Collection Two



(1) The object and picture sets were presented in 2 separate collections of 3 sets each.

(2) One shape correspondent and one colour correspondent was offered for each object. The 2 pictures offered for each object are those shown in the corresponding column position (ie., left, centre or right respectively).

Figure 18 Schematic representation of the design of Study Six.

72 Ss

SESSIONS 1 & 2	24 Ss receive the choice-preference tasks for the members of the 6 object sets. Objects are merely presented physically (ie., condition P).	24 Ss receive choice-preference tasks in which they are shown the objects and given both a type name and a relevant modifier for each (ie., condition P-T-M).	24 Ss receive choice-preference tasks in which they are not shown the objects but are given the type name plus a relevant modifier for each (ie., condition T-M).
SESSION 3	Finally, each S receives type and then verbal knowledge tests.		

P-T-M or T-M). Each S participated in three sessions. In the first two sessions, Ss received the choice-preference tasks for the 6 object sets. To achieve this, the 6 sets were grouped into 2 collections of 3 sets each and Ss received one collection in each session. Each collection comprised one colour-type set, one shape-type set and one type-different set. Of the 2 type-same sets in each collection, one set had 'neutral' type-discordants and one set had 'non-neutral' type-discordants. The composition of the 2 collections is indicated in Figure 17. In the third session, Ss were presented with type and verbal knowledge tests.

In the choice-preference task sessions, the ordering of the two object and picture collections was counterbalanced for the Ss in each presentation condition. Thus, 12 Ss in each condition received the collections in each order. Each of the sub-groups of 12 Ss was balanced for mean age, age range and sex. The presentation order of the object sets comprising each collection was balanced for each sub-group of 12 Ss. Also balanced for each sub-group of 12 Ss was the position of the pictures in each of the picture sets on the picture mounts. In balancing the picture positions the provisos were made however that the pictures should be arranged in 2 horizontal rows of 3 pictures each, that the members of each picture pair (ie., the shape and colour discordants offered for each object) should be in different rows but in the same position (ie., left, centre or right) in their respective rows and that, for the type-same sets, the colour discordants should be presented in one row and the shape discordants in the other row. Because neither shape nor colour correspondence was consistently correlated with the type-defining value for the members of the type-different sets (as was the case for the type-same sets), it was further decided that, for the type-different sets, each S should receive shape discordants and colour discordants in separate rows in the first session and type-discordants and modifier-discordants in separate rows in the second session.[16]

Consider finally, the type and verbal knowledge tests presented in the third session. The present hypotheses presume that the Ss will appreciate the type status of the various picture options and that those Ss in the verbal presentation conditions will understand the modifiers given. The information provided by each of the knowledge tests was therefore potentially critical with regard to the interpretation of the results if these results were not as predicted. In the event however, it transpired that the modifiers elicited strong effects (cf., Section 4.3.3) and consequently the results of the verbal knowledge tests are not used in the results' analyses. Since this is the case, only the details of the type knowledge test will be reported below. Concerning this test, it should be noted here that the pictures were presented for this test on the cards upon which they were mounted in Sessions One and Two respectively. These picture cards were presented to each S in precisely the same order and, insofar as was possible, with the pictures in the same position as that in which they were received in Sessions One and Two. Because the 8 pictures of the 4 critical objects were presented twice however, it was determined that these pictures should be presented in the sets (and in the positions in these sets) in which they appeared first.[17] It should also be noted in relation to the type knowledge test that the format was not

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[16] Having made these provisos, there were only 12 possible picture arrangements for each picture set: thus 1 S in each sub-group received each of these arrangements.

[17] In practice, this meant that Ss received on this test, 3 picture sets with 3 picture pairs each, immediately followed by 3 picture sets of which two sets had 2 picture pairs each and one 'set' had a single picture pair.

the same as that used in previous studies. Specifically, rather than being asked to say whether members of a given type can look like the relevant pictures, Ss were asked to name the pictures themselves. The new format was chosen because it was considered that there was a danger that, for the two trios of very similar pictures in each of the type-same picture sets, a critical question which could be answered simply by 'yes' or 'no' might have elicited automated responding. Details of the type knowledge test are given in Section 4.3.2 (d) ii.

4.3.2 (d) Procedures

4.3.2 (d) i Choice preference tasks

These tasks were cast, as in the main experimental tasks in Studies One, Two and Five, respectively, in the form of a shopping game, this time with a doll serving as the shopkeeper. Ss were first 'introduced' to the doll and it was then explained that the dolly "has a little shop", that she "sells things in her shop" and that these things were contained inside boxes. At this point, the boxes containing the 3 objects in the first set to be presented were placed on the table. Those Ss in either of the two conditions in which the objects were to be seen were then encouraged to open the boxes, and, according to whether they were in the spontaneous condition (P) or the description condition (P-T-M) were either asked to name the objects themselves or were given a description of each object by the E (the latter descriptions are given in Figure 17). The lids of the boxes were then closed (with one object inside each box). Those Ss for whom the objects were only to be described (condition T-M) were told that because the boxes were 'stuck-up' (which, for these Ss, they were), the E would tell them what was inside each box. The descriptions of each object which were given to these Ss were precisely the same as those descriptions given to P-T-M condition Ss.

As in the previous studies employing the 'shopping paradigm', it was then demonstrated to each S that if the boxes were rapidly rearranged, then he (or she) could not accurately remember the contents of each box. It was then suggested that a picture should be stuck onto each box -

> "to show the dolly what's inside - she can look at the picture on the top of the box and then she will know what's inside the box".

The pictures on the card appropriate for the particular object set were then presented. The 3 picture flaps were opened simultaneously and Ss were given a short time (15 seconds or so) to study them.[18] (Ss in conditions P and P-T-M respectively, were able to compare the pictures with the objects since the box lids were open at this point.) Each S was then reminded of the names of the objects in the set (for Ss in condition P, the name which they themselves had given to each object was repeated whilst, for the other Ss, the names given previously by the E were repeated). The children were then asked to choose "the box we should do first". The 2 flaps positioned over the 2 irrelevant picture pairs were then closed and Ss were asked of the 2 pictures remaining the critical question -

> "So, which of these pictures should we put on to help the dolly remember that there's a _____ (ie., name given by S or predesignated name depending upon presentation condition) inside the box?"[19]

Immediately after making the picture selection, Ss were asked to justify their choice. The question used was: "Why do you want to choose that one?" Ss were then asked to choose a second box, the object inside was named (by the S or the E depending upon condition) and the critical question and the justification question respectively were then repeated in relation to the relevant pictures. This procedure was repeated for the third object in the set (although clearly, the final object did not require to be selected). When this had been done, Ss were asked to name the contents of each box.

Once the procedures in relation to the first object set had been completed, Ss were told a story about what happened when people

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(18) Ss were given this opportunity to view the 6 pictures in each set simultaneously so that it was possible for them to recognise that they could adequately represent each of the objects in the type-same sets by choosing the modifier-concordants. It was in order that this recognition might be facilitated that the type-and modifier-concordants respectively were presented in separate rows for these sets.

(19) N.B. If Ss had had free access to all the pictures on the picture card then, for the type-same object sets, the chances of a type-concordant being selected as a consequence of random selection would have been considerably greater than the chances of the appropriate modifier-concordant being randomly selected. (By contrast, for the type-different sets, the probabilities of the chance selection of appropriate type-concordants and modifier-concordants respectively would be equal).

came to buy the objects for sale in the dolly's shop. This story lasted about 3 minutes and culminated in the dolly, having sold all the items, arriving at the shop the next morning to find a lorry parked outside which was loaded with more boxes containing things for her to sell in the shop. When this point in the story was reached the E 'wheeled in' a lorry loaded with the boxes containing the second set of objects.[20] The boxes were then unloaded, the objects were named (by the S or the E as appropriate) and the critical features of the procedure were then repeated.[21] Once the decisions relating to the second set of objects had been made, a story was told in relation to the sale of these items which culminated in the same fashion as the first story and the third set of objects was then presented.

The procedures followed in Session Two were identical to those followed in Session One.

4.3.2 (d) ii Knowledge tests

The procedure followed in Session Three was the same for all Ss. Having been informed that they were to be shown the pictures which they had seen when they had previously come to "play the games", Ss were told that some of these pictures: "are pictures of real things" but that others, "don't look like anything". Ss were then simply shown all the pictures in the first picture set and asked, one-by-one, to name all the pictures that they could. This process was then repeated for the pictures on the 5 remaining picture cards. When this had been done, Ss were presented with the verbal knowledge test.[22]

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[20] The chief reason for telling this story was to emphasise that only those objects in any one set were present in the shop at any one time and thereby to reduce the likelihood of order effects resulting from inter-set influences.

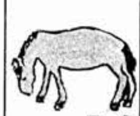
[21] The procedures used were basically those used for the second and third objects in the first object set; that is, these procedures were used for all 3 objects in the second (and third) object set(s). In addition however, for the first object presented, the complete picture set was exposed for a short time just as it was for the first object presented in the first object set.

[22] The reasons for not giving the details of this test have been given previously (cf., Section 4.3.2 (c)).

4.3.3 Analysis of results

The main effect being tested for was whether there is any evidence, in any of the object presentation conditions, that the children's correspondence preferences for the four critical objects shifted according to whether the objects occurred in type-same or

Table 12 Numerical breakdown for each presentation condition of the picture choices made for each critical object in type-same and type-different sets respectively.

MODEL OBJECTS	PICTURE OPTIONS	PICTURE CHOICES: P type-different object set	P type-same object set	P-T-M type-different object set	P-T-M type-same object set	T-M type-different object set	T-M type-same object set
	 T.C[1]	20	19	16	9	18	10
	 T.D	4	5	8	15	6	14
	 T.C	22	20	20	9	19	12
	 T.D	2	4	4	15	5	12
	 T.D	9	18	14	22	20	21
	 T.C	15	6	10	2	4	3
	 T.D	1	4	12	23	18	20
	 T.C	23	20	12	1	6	4

(1) N.B. Pictures concordant with regard to a type-defining value (but discordant with regard to a type-modifying value) are marked 'T.C'. Pictures discordant with regard to a type-defining value (and concordant with regard to a type-modifying value) are marked 'T.D'.

type-different sets. Because of constraints upon space, only the results which pertain directly to this question will be considered. The basic findings are given in Table 12. If the picture choices for the two kinds of object set in each presentation condition are compared it becomes apparent that, in all but a few cases, Ss choose the type-discordants rather more when the critical objects appear in type-same sets than when these same objects appear in type-different sets. Each of these comparisons may be assessed statistically by applying the sign test to the number of choices made for the type-concordants and the type-discordants respectively for each model object and for each presentation condition. Those of these comparisons which in this way attain statistical significance are, for the model comb, conditions P-T-M and T-M ($p = 0.016$ and 0.022 respectively); for the model toothbrush, conditions P-T-M and T-M ($p = 0.004$ and 0.04 respectively); for the model biscuit, conditions P and P-T-M ($p = 0.022$ and 0.008 respectively) and, for the model horse, condition P-T-M ($p = 0.002$). It is apparent from these figures that the only object presentation condition which reliably elicited significant shifts in correspondence preferences as a function of set composition was the P-T-M condition. In addition, the two shape-type models elicited significant shifts for the T-M object presentations (though these shifts were not as strong as those occurring for the same stimuli in the P-T-M condition) whilst one model (the biscuit) elicited significant shifts in the spontaneous object presentation condition (P).[23]

Consider next the results for those comparisons where correspondence preferences do not shift significantly according to set composition. It is evident from Table 12 that there is a very distinct variation between the two presentation conditions involved - that is, conditions P and T-M respectively - in the correspondents that are chosen. Specifically, whereas for condition P the pertinent preferences (ie., for the comb, toothbrush and horse models respectively) are for the type-concordants, in condition T-M these preferences (ie., for the biscuit and horse models respectively) are for

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[23] N.B. A clear majority of Ss in condition P named the objects at the type-level for both the type-different and the type-same presentations respectively. (See Appendix D for a breakdown of these results.)

the modifier corresponding type-discordants.

There is little evidence in the present results of any general effect whereby correspondence preference shifts are more likely to occur when the type-discordant offered is type-neutral (as it is for the comb and biscuit models) than when the type-discordant is openly and explicitly misleading as to type (as it is for the toothbrush and horse models). Thus, within the confines of the present variables, the optimum conditions for the occurrence of informationally sensitive shifts in the children's correspondence preferences are those provided by the P-T-M presentation condition - which produced significant shifts in correspondence preferences for each of the four critical models. The remaining presentation conditions each had some success in eliciting preference shifts but these shifts were by no means widespread. Several reasons as to why these isolated and irregular effects may have occurred arise from the present data; these potential explanations will now be discussed.

Consider first why the biscuit model is the only model which elicited significant shifts in correspondence preferences in presentation condition P. It is interesting, in relation to this question to consider the outcome of the type knowledge tests. Table 13 shows the numbers of erroneous identifications which Ss made with regard to the type status of the type-discordants and type-concordants offered for each of the critical models. It is apparent from this table that Ss made many more errors with regard to the type status of the biscuit choice-stimuli than they did with regard to the type status of the other choice-stimulus pairs. Indeed what Table 13 does not show is that of the Ss in presentation conditions P, P-T-M and T-M, only two, three and zero Ss respectively accurately differentiated the type status of both the biscuit choice-stimuli. The frequency with which Ss on the one hand named the type-discordant biscuit stimulus as a biscuit and on the other, omitted to name the type-concordant biscuit stimulus as a biscuit would seem to indicate that the salience of the type differences between these two choice-stimuli are not nearly as great as the type differences which are perceived between the choice-stimuli offered for the three other critical models. This finding may potentially explain why, in the P presentation condition, Ss were much more willing (cf., Table 12) to

Table 13 Performance on the type knowledge test.

Model Stimuli	No. of Ss erroneously naming type-discordant with type name of model			No. of Ss failing to name type-concordant with type name of model		
	P	P-T-M	T-M	P	P-T-M	T-M
yellow comb	0	0	1	0	0	0 [(1)]
red toothbrush	0	0	0	0	0	0
round biscuit	13	12	16	13	12	14
'sitting' horse	4	4	8	0	0	0

(1) N.B. The response 'hairbrush' was scored as equivalent to that of 'comb'.

select the type-discordant for the biscuit model than the type-discordants for the other models. It should be emphasised however, that the results of the spontaneous naming (or type knowledge) tests do not explain how it was that so many P condition Ss actually shifted their correspondence preferences for the biscuit model from the type-concordant to the type-discordant according to the composition of the set; presumably though, a reasonable number of children did recognise the difference of type status between the two biscuit choice-stimuli even if this recognition was not reflected in these children's performance on the spontaneous naming test. This question will be discussed further in Section 4.3.4.

A second anomalous feature of the results reported in Table 12 concerns why, in the T-M presentation condition, the comb and toothbrush models elicited strong shifts in correspondence preferences according to set composition whilst the biscuit and horse models tended, overwhelmingly, to elicit the choice of the modifier-concordants independently of set composition. It is evident that, in the case of the two shape-type models, the results obtained in the T-M condition largely reflect a continuation of the pattern of results obtained for these stimuli in the P-T-M condition. Since neither of the shape-type models elicited significant shifts in correspondence preferences in the P condition it would seem to be apparent that the shifts occurring for these models in the T-M condition derive directly from the modifiers which were given. In the case of the two colour-type models, however, the widespread choice of the modifier-concordants which occurred in the T-M condition stands in marked contrast to the preference shifts obtained for these models in the P-T-M condition and would seem therefore to be directly attributable to the omission of the physical presentation of the models. For these models then the omission of the physical presentation of the models appears to lead to Ss placing more weight upon correspondence with regard to type-modifying values than upon correspondence with regard to the type-defining value for the type-different sets. Of some relevance to the anomaly between the correspondence preferences elicited by the colour-type and shape-type models respectively in the T-M condition may be the type knowledge data presented in Table 13. Specifically, this table indicates that Ss erroneously gave the type-discordants the type name of the model presented more often in the case of the colour-type models than in the case of the shape-type models. This issue will be discussed further in the next section.

One finding not yet noted but which warrants mention is that the results were complicated by the appearance of a number of asymmetric order effects. Specifically for some of the object models, Ss were more likely to evidence a preference shift from the type-concordant on the type-different object set to the modifier-concordant on the type-same object set if the type-different set was presented before the type-same set than if the sets were presented in the reverse order. What happened in these cases was that whilst preference shifts occurred when the type-different set was presented first, when, instead, the type-same set was presented first, Ss tended to choose the modifier-concordant for both type-same and type-different sets. Thus, the experience of receiving the type-same set first (and the ensuing choice of the modifier-concordants) appears, for some Ss, to disrupt the preference which they would otherwise have had for the type-concordant for an equivalent model occurring in a type-different set. The strongest of these order effects are indicated in Table 14. Thus, taking the most pronounced effect as an example, for the horse model (condition P-T-M), of the 12 Ss who received the model in a type-different set first, 10 of them chose the type-concordant but then subsequently chose the modifier-concordant when the model was re-presented in a type same set; whilst by contrast, of the 12 Ss who received the

Table 14 Asymmetric effects resulting from presentation order of type-different and type-same sets respectively (cf., text).

Model objects	Object set order	Picture choices[2]			
		P		P-T-M	
		t.m	m.m	t.m	m.m
yellow comb	T.D;T.S[1]			6	1
	T.S;T.D			1	7
round biscuit	T.D;T.S	8	2		
	T.S;T.D	3	5		
horse sitting down	T.D;T.S			10	1
	T.S;T.D			1	11

(1) N.B. 'T.D' stands for type-different set and 'T.S' for type-same set.

(2) Picture choices are given as a function of presentation condition; 't.m' denotes type-concordant chosen for type-different set and modifier-concordant chosen for type-same set whilst 'm.m' denotes modifier-concordant chosen for both sets. Details of the numbers of Ss making the remaining picture-choice combinations are given in Appendix E.

same model in the type-same set first, 11 Ss chose the type-discordant both for that set and for the type-different set presented subsequently. The corresponding data for the conditions not featured in Table 14 are included (for comparative purposes) in Appendix E.

Some consideration should finally be given to the justifications given by Ss who changed their picture preferences in line with the informational demands of the object sets. Table 15 presents an analysis of these children's justifications for those stimulus conditions in which the number of such shifts in correspondence preferences was significant. Of particular interest is how the justifications based upon type - for example, "because that's a comb in there" - and the justifications based upon a dimensional correspondence - for example, "because it's the same colour" - are distributed. It is apparent from Table 15 that, except for two conditions (that is the biscuit P and the toothbrush T-M conditions respectively), the type-different object sets elicited a majority of type based justifications. By contrast, in each of the type-same object set conditions (without exception), the majority of justifications given were dimensionally based. A full verbatim report of all the justifications coded in Table 15 is given in Appendix F.

Table 15 Breakdown of the numbers of different kinds of justification given for picture choices by Ss whose preferences shifted from type-concordant to modifier-concordant for type-different and type-same sets respectively.

Model stimulus and presentation condition	No. of Ss	Kinds of justification								
		type-different set					type-same set			
		type	dimensional	indeterminate(1)	none(2)	erroneous(3)	dimensional	indeterminate	none	erroneous
yellow comb, P-T-M	7	7	-	-	-	-	5	2	-	-
yellow comb, T-M	9	5	-	2	1	1	5	2	-	2
red toothbrush, P-T-M	12	10	-	2	-	-	11	-	1	-
red toothbrush, T-M	8	4	-	2	2	-	6	-	2	-
round biscuit, P	11	6	2	-	3	-	6	-	1	4
round biscuit, P-T-M	8	2	4	1	1	-	5	1	2	-
horse sitting down, P-T-M	11	10	1	-	-	-	7	2	-	2

(1) eg., with regard to the model comb, "because it's a yellow comb inside" or, with regard to the type-concordant biscuit picture, "'cause it's a square biscuit."

(2) this category includes responses such as, "show the dolly, see what's in it."

(3) eg., with regard to the type-concordant comb picture, "because it's red."

4.3.4 Discussion

The present study obtained some evidence that preschool children do, on an object coding task, judge the relative importance of correspondence with regard to shape and colour respectively, to vary according to the composition of the set in which the model objects occur. Specifically, whereas preschoolers typically prefer pictures of objects which occur in type-different object sets to correspond to their respective models with regard to a type-defining value rather than a type-modifying value, when these same objects occur in type-same sets the same preschoolers may then prefer pictures of the models to correspond with regard to the type-modifying value rather than the type-defining value. The occurrence of these shifts in correspondence preferences - which permitted the objects in each object set to be differentially coded - was found to be maximal when the model objects were presented physically and the modifying values were articulated (ie., in the object presentation condition P-T-M). The study did not however, find any widespread evidence that the nature of the type-discordant (that is, whether it is 'neutral' rather than 'directly misleading' as to type) influenced subjects' correspondence preferences systematically.

These general findings aside, there were a number of anomalies in the study which require some explanation. The first of these was that one critical model (the biscuit) elicited meaningful differential correspondence preferences according to the composition of the object sets when the modifying-values were <u>not</u> articulated (ie., in object presentation condition P). It has previously been observed (cf., Section 4.3.3) that subjects failed to distinguish adequately the type status of the two picture options for this model. In particular, many children accepted the type-discordant option as a type-concordant. Thus, rather than treating this stimulus as being neutral as to type (as they did for the type-discordant comb picture) these children actually accepted it as a type-concordant. This feature of subjects' identification of the biscuit materials would seem likely to have facilitated their choice of the modifier-concordants when the type-same biscuit set was presented. One other feature of these materials which may be relevant is that the critical modifying values were each geometric forms; this is significant because Corah (1966) has argued that geometric forms are, (compared with representational forms) especially salient for young children relative to colours.

The second anomalous finding was that, when the objects were not presented physically but only described (that is, in condition T-M), the two shape-type models but not the two colour-type models elicited significant numbers of changes in correspondence preferences in an informationally meaningful fashion, according to the composition of the object sets. It was noted in the previous section that this anomalous result may have some basis in the relative inability (or unwillingness) of subjects to detect the type status of the type-discordants offered for the colour-type models (by contrast, the type status of the type-discordants offered for the shape-type models was readily identified). It has been argued above (cf., Section 2.3.3) that the physical presentation of a model directly elicits type-based responding; it therefore seems likely that the omission of a physical presentation of the objects in the present T-M condition combined with the relatively poor type differentiation of the colour-type options to produce the widespread choice of the modifier-concordants which occurred for the colour-type models. Finally, one other factor which may be relevant here is that it is commonly believed that whilst shape is often used as a discriminator at the generic level of abstraction, colour tends to be used as a discriminator at lower levels of abstraction. Nelson, for example (cf., also, Brian and Goodenough, 1929), having noted that roundness is used by children to identify instances of the concept 'ball', observes that,

> "Color .... is a highly salient dimension for young children, although it is rarely useful for the purpose of identifying concept members, and is, in fact, seldom used for category generalization by young children (Clark, 1973). However, color is extremely relevant and useful in enabling the child to distinguish between instances of the same category, that is, for establishing the identity of single objects (Nelson, 1974, p. 278; emphasis in original)."

Nelson's comments are, without doubt, an over-generalisation. However, it does seem likely that young children will have had most experience of using shape as a discriminator at generic levels of abstraction and of using colour as a discriminator at lower abstraction levels. In relation to the latter, it is noteworthy that it does seem likely that many of the subjects tested were - as a consequence of their everyday experience - familiar with the process of distinguishing individual toothbrushes on the basis of a colour code. It does therefore seem feasible that, in the present task, subjects may have found it more natural to change their correspondence preferences from shape to colour for type-different and type-same object sets respectively than to switch their correspondence preferences from colour to shape for type-different and type-same object sets, respectively.[24]

Concerning those subjects who changed their correspondence preferences meaningfully according to the composition of the object sets, one question of considerable importance is how (if at all) conscious these subjects were of the informational consequences of their picture choices. It is possible that rather than making these picture choices deliberately so as to code the objects differentially, subjects were in fact merely responding to some sort of summation of cues which quasi-automatically forced them into making the choices they did. Werner (1948) for example, in his discussion of perceptual grouping (cf., Section 1.3 above) observes that objects or events may be grouped together on the basis of a perceptual similarity with very little in the way of 'conceptual-abstract support'. In particular he observes that the kind of perceptual grouping made will, in these circumstances, determine how the individual object is conceived. To illustrate his point, Werner asks his readers to consider two situations: first the vowels a-e-i-o-u sung one after the other at a constant pitch and second, the vowel 'a' sung alone to the tune of some melody. As Werner observes, whereas in the first situation the vowel sound 'a' is expressed as a vowel, in the second situation the same sound is expressed as a tone. Thus, the subjects' perception of the figuration in which the individual element stands, directly determines how the individual element is conceived. The potential relevance of Werner's observations for the present results is that it might be argued that the children's choice of the modifier-concordant pictures for objects occurring in

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[24] N.B. For the type-different sets, coding was possible at a generic level of abstraction whereas for the type-same sets, coding was required to be at a lower level of abstraction.

type-same sets may actually demonstrate nothing more than that young children possess patterns of sensory organisation whereby the members of a set of objects varying only in respect of fixed values on a single dimension are automatically conceived of in terms of those varying dimensional values. Nevertheless, in considering how exactly the present results might be accounted for in terms of Werner's perceptual grouping effects, it is apparent that since the present study found that subjects selected the modifier-concordants for several of the type-same object sets even when the objects were not physically presented but were only described, Werner's perceptual grouping effects must, to be viable, be capable of being grounded solely in the sounds of the various verbal labels which were given to the objects in each of the sets. It is possible that some perceptual grouping effects may be mediated solely by the sounds of the verbal labels given to the objects. Consider, for example, the red toothbrush model. The labels given to the objects in the type-same and type-different sets respectively, in which this model was presented were as follows.

1. red toothbrush	1. red toothbrush
2. orange toothbrush	2. round biscuit
3. green toothbrush	3. blue scissors

It would seem (subjectively) that, in the type-same set, the colour names do acquire a certain salience as a consequence of the constancy of the type name. In the type-different set, by contrast, there does not appear to be a comparable effect.[25] The possibility cannot therefore be ruled out that the picture choices made for the type-same sets (that is, the modifier-concordants) may have been mediated by some kind of perceptual grouping effect[26]; it does seem virtually certain however that the picture choices made for the type-different sets are not attributable to a perceptual grouping effect.

There is only one source of widespread evidence in the present study which is relevant to the question as to the extent to which

(25) Nevertheless, it might possibly be considered, even so, that there is a tendency for the type names to predominate.

(26) It should be emphasised though that Werner (op.cit.) does not himself mention the possibility that perceptual grouping effects may sometimes be grounded in the sounds of spoken words.

subjects were conscious of the informational consequences of their picture choices. This evidence derives from the justifications which subjects gave for their picture choices. The analysis made of subjects' justifications (cf., Section 4.3.3) indicated that whereas the justifications offered for the selection of type-concordant pictures for model objects occurring in type-different sets were mostly type-based, the justifications offered for the selection of modifier-concordants for model objects occurring in type-same sets were largely dimensionally-based. This shift in the bases of the majority of justifications offered for the picture choices made with regard to type-different and type-same object sets respectively is suggestive since it does indicate that at the very least, subjects were generally aware of the bases of correspondence which they chose; nevertheless, however, the justification data does not prove that the subjects involved in each comparison were fully aware of the informational consequences of each of their picture choices. Additionally, one general problem with justification data which should be noted is that there is no guarantee that the justifications given indicate the real reasons for the decisions that have been made; justifications may merely be post-hoc rationalisations. Of particular interest therefore are those comments which were not solicited but which some subjects volunteered and which imply that picture choices - particularly in the case of the type-same object sets - were made with the informational consequences "in mind". In several cases subjects revealingly articulated the dilemma of the picture choice they were faced with. One subject even went so far as to accuse the experimenter of providing an inadequate selection of pictures; this statement, made in relation to the toothbrush type-same set was as follows:

> "You've got it wrong. The jugs are the right colours but the toothbrushes are the wrong colours. You've got it wrong!"

Another subject, on being shown the six picture options available for the type-same comb object set, observed:

> "'cause we'll have to use those (ie., the modifier-concordants) won't we, instead of the combs (ie., the type-concordants). Because they're the right colours. Hey what are those? (ie., the modifier-concordants."

When it came to actually making the picture choices, several other revealing comments were made. One child for example, selected the red jug for the red toothbrush on the type-same object set and asked: "I can pretend this (ie., the jug) is a toothbrush can't I?" Similarly, another child observed in relation to a member of the same object set: "Green toothbrush. That's why, I'll use the green jug." Comments such as these were made in only a minority of cases. When however these comments are viewed within the context of the justifications given by each of the subjects who shifted their correspondence preferences according to set composition, it does seem likely that it was in fact more than a small minority of subjects who deliberately selected the modifier-concordants for the objects occurring in type-same object sets in order to code the objects differentially.

Several comments which were made spontaneously by subjects in the present study do draw attention to an important feature of the present task. Specifically, it would appear that several children refrained from selecting the modifier-concordant picture options for the objects in the type-same sets because they doubted that the dolly would then be able to remember the type of the objects inside. One child for example, having selected the modifier-concordant pictures for the first two objects in the type-same horse set, commented:

> "but dolly will think zebras inside (ie., inside the first two boxes)"-

and then chose the type-concordant picture for the final object.[27] This comment does suggest then that in some cases subjects may have chosen the type-concordants for objects occurring in type-same sets not because they themselves were unaware of the informational advantages of selecting the modifier-concordants but rather because they recognised that if they chose the modifier-concordants there would be no means of coding the type of the objects in such a way that the dolly could be relied upon to remember the appropriate type. It therefore seems likely that if subjects had not been

(27) It should be emphasised however that most subjects who chose the type-concordants for objects occurring in type-same sets apparently did so because they simply considered the selection of a type-discordant to be out of the question. Thus one subject observed in relation to the orange toothbrush model:

> "that's orange but we can't put that on can we? because that's a milk. And that's a blue toothbrush. I think that one's the best (ie., the type-concordant) because that's a blue toothbrush."

required to demonstrate their sensitivity to the informational demands set up by different object sets independently of correspondence on type-defining values (for example, by presenting type-same arrays in which neither shape nor colour is a type-defining value - cf., Figure 15 (p.117); or, alternatively by employing a correspondence requirements task rather than a choice-preference task), the present study would have obtained greater evidence than it has done that young children are sensitive to the informational demands set up by the varying composition of different object sets. Nevertheless, it must be emphasised that if subjects were not required to set aside correspondence on type-defining values in order to satisfy informational demands then they would not be required to treat the stimulus materials as arbitrarily as the present task requires.[28]

It was noted above (cf., Section 4.3.1) that the modifier-concordants function on the type-same sets as virtual symbols. One significant conclusion which therefore follows from the present results is that young children would seem to be well on their way to a proper understanding of the use of symbols.[29] It has long been apparent that young children use many common nouns to refer systematically to certain kinds of objects. What has not been so clear however is the extent to which young children are able to consciously employ symbolic kinds of thinking for themselves. In the present task the children were required to use representational material in relatively arbitrary ways in order to satisfy an external informational constraint. The present study found that children's picture choices were most likely to reflect symbolic forms of thinking when objects were both physically presented and also described. This

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(28) There is one method however which might possibly be used to examine children's ability to use type-discordant stimuli as informationally meaningful correspondents in conditions where the type of the models need not remain ambiguous. Specifically, subjects could be given the opportunity to classify model objects at two levels of abstraction. In making provision for this possibility it could be arranged firstly, for objects of the same type to be jointly codeable under a type indicator and secondly, for individual objects to only be differentially codeable with type-discordant stimuli.

(29) It is noteworthy in this regard that 46 per cent of the children in the P-T-M condition changed their picture preferences according to set composition in an informationally appropriate fashion for two or more of the four critical models.

finding suggests then that language cues may assist the development of children's ability to use symbolic forms of thought to satisfy external informational constraints. Interestingly, this conclusion is consistent with Luria's (1961) suggestions concerning the role of speech in the development of self-regulatory mechanisms (cf., Section 2.1). The present results also add credence to the conclusion reached by Chalmers and McGonigle (1979; cf., Section 4.3.1) that the nature of young children's difficulty with referential communication tasks lies primarily in their relative inability to generate adequate descriptions.

It should be emphasised that each of the descriptions given to objects in the present study included a reference both to the type-defining value (which was implicit in the type name) and (more explicitly) to the type-modifying value. Moreover, the same object descriptions were of course given to each critical object in both type-different and type-same sets. Thus the finding that the giving of these names had a differential effect upon subjects' picture choices for objects in type-different and type-same sets respectively (and that some proportion of these subjects appeared to be conscious of the informational consequences of the picture choices) does tend to suggest that subjects were already - at some level or other - predisposed to respond differentially to objects in these two different object contexts. It seems then that, in the case of the type-same sets, the articulation of modifiers increased subjects' attention to the importance of maintaining correspondence with regard to the values marked. By contrast, in the case of the type-different sets, modifiers seem to have generally been ignored. The present finding that, in the verbal presentation conditions, receipt of the type-same set before the type-different set tended, for some of the models, to cause subjects to choose the modifier-concordant on both sets may be taken as an additional indicator of the degree to which these subjects were sensitive to the informational demands of the type-same sets.[30]

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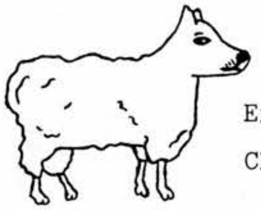
[30] This effect may, to some extent, be related to the more general effect reported by Ford and Olson (1975) and discussed above (Section 4.3.1) whereby subjects' references (equivalent in the present study to their picture choices) are a function of all the dimensions known by the subject to have been varied rather than being merely a function of the immediate context in which the model object appears. However, to the extent that the present effect was order related rather than generally confounded, it must be attributed to subjects actually having learnt - through having received a type-same set - to value the modifier-concordants more highly than they would otherwise have done.

It should finally be stressed that the children taking part in the present study were found to be generally insensitive to the varying informational consequences of different set compositions when descriptions of the objects at the level of the noun phrase were not given. Specifically, in this condition, subjects widely chose the type-concordants independently of set composition. It therefore seems most reasonable to conclude that, whilst evidently possessing some sensitivity to the differing informational demands set up by variation in the composition of object sets, young children are not generally adept on such tasks. Nevertheless, the extent to which subjects demonstrated themselves to be capable of performing satisfactorily when objects were verbally described does suggest that young children are beginning to acquire a capacity for classifying representational material as a function solely of specific informational demands. It is noteworthy in this regard that young children's widely reported failure to reclassify material presented on classification tasks fails to give any indication that young children will perform as well as they were found to on the present tasks. One reason why the subjects in the present study who were given verbal cues performed as competently as they did seems likely to be that the varying informational demands of the different object sets provided a <u>sound reason</u> for classifying the materials in different ways.

CHAPTER FIVE: PRESCHOOL CHILDREN'S DETECTION OF ANOMALIES AND AMBIGUITIES IN REPRESENTATIONAL MATERIALS



Experimenter: And what do you think this one is?
Child (4:3 years) . . . A sheepdog! (chortles).

5.1 Statement of the issues to be investigated

The question which has united each of the investigations which have been reported in the previous experimental chapters has been whether or not young children are as limited in their ability to co-ordinate sources of perceptual information as has often been supposed in the past (cf., Chapter One). The investigations so far reported have each been interpreted as providing evidence that young children can and often do co-ordinate perceptual information in systematic ways. The present chapter reports a study which extends the scope of the present investigations by examining children's ability to make the perceptual co-ordinations required to detect anomalies and ambiguities respectively. Previous investigators have concluded that young children lack the co-ordinative skills required for success on such tasks; however the tasks used seem to have been unnecessarily complex (cf., Section 1.2). The present study was therefore set up to examine children's performance with more straightforward tasks.

The kind of co-ordinative skill which is required to spot anomalies and ambiguities respectively would seem, subjectively at least, to be quite distinct. Specifically, whereas the detection of anomalies requires merely the recognition that two or more features of a stimulus are not compatible, the detection of ambiguities requires by contrast, that whole stimuli be perceptually reorganised, each of the possible perceptual organisations being non-anomalous. Upon reflection, it is also apparent that if all the elements in an anomalous figure are perceived in a co-ordinated fashion then the anomaly should normally be detected, whereas the systematic co-ordination of all the elements in an ambiguous figure will not necessarily lead to the detection of the ambiguity therein.

Although none of the earlier studies reported in this thesis have been concerned with investigating children's ability to detect ambiguities it is evident that most of these studies have been in someway concerned with children's ability to detect anomalies. In the past, the kinds of anomalies which have been used in developmental research have been anomalies that occur at the type-level of abstraction. It was this kind of anomaly which the current study presented. Now the studies reported in earlier chapters have found that young children do generally prefer, when judging correspondences between objects and pictures, that pictures correspond to objects with regard to type-defining values (as well as with regard to type-modifying values) - cf., Section 2.2. There are, however, several distinctions which should be drawn between the present investigation and these previous studies. The first of these is that in the current study, no model objects were presented (or, for that matter described) and consequently subjects were required to base their detection of anomalies solely upon their knowledge of the object types depicted. In this way, the anomalies presented each occurred at the type level of abstraction. The most important characteristic of the present study, however, is that it is concerned solely with <u>partial</u> shape-type discordances. Now children's ability to detect a partial shape-type discordance has already been given some (albeit rather limited) empirical attention; significantly, however, it was found in relation to the pertinent stimulus - that is a teapot with a spoon bowl substituted for the spout (cf., Section 2.3) - that young children were not very competent at detecting this anomaly. This finding may be critical because it is precisely this kind of partial shape-type discordance which was presented in the original anomaly studies (cf., Section 1.2). It may be therefore that children detect gross (or complete) shape-type discordances but not partial shape-type discordances. It seems more likely, however, that children will detect some partial shape-type discordants but not notice the most subtle of such anomalies. One interesting question which arises in this regard is the point at which adults begin to start failing to detect the more subtle anomalies.[1] An additional question concerns the extent to which failures to detect anomalies arise from a lack of knowledge as to the particular type identity of

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[1] It should be noted that a study was conducted with adults for comparative purposes. The results of this study will be cited at appropriate points in the present chapter. The methodological details of this study are given in Appendix G.

the parts combined. These issues constitute the basis of the current study of the detection of anomalies. It should be noted that evidence has previously been reported (cf., Chapter Three) which strongly suggests that children (and adults) naturally organise their concepts of objects at the type level of abstraction. The anomalies presented in the current study were anomalous drawings of animals. It was therefore anticipated that the study would also reveal something about children's shape-type knowledge of animal types - how it is structured, how precise it is and so on. Piloting for this study yielded the response featured at the head of the title page of the present chapter. Such verbal humour was admittedly exceptional; however, more generally the results of this pilot study did suggest that studies by previous investigators (cf., Section 1.2) have underestimated the ability of young children to detect partial shape anomalies.

With regard to the current investigation of the extent to which young children are able to detect ambiguities, it requires only to be observed at this point that previous studies of this issue have a number of shortcomings (concerning the presentation of highly stylised figures; cf., Section 1.2) which the present study sought to avoid. Because the intention in conducting the current study was to discover the extent of young children's ability to detect anomalies and ambiguities respectively, the children participating were informed as to the special nature (or the potentially special nature) of the materials they viewed. This feature of the study is important because previous studies of children's performance with anomalous and ambiguous materials have generally failed to provide subjects with such information (cf., Section 1.2).[2]

5.2 Study Seven: A study of preschool children's ability to detect anomalies and ambiguities.

5.2.1 Introduction

Since the processes involved in spotting anomalies and ambiguities respectively would seem to be relatively distinct (cf., Section 5.1)

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[2] This feature of the study may be of special significance in respect of the presentation of the ambiguous figures. It is note-worthy in this regard that, in the course of an informal pilot, several adults who were presented with a series of ten ambiguous figures (selected from those reproduced by Fisher 1968) and who were asked merely to identify the 'drawings', failed to spot a single ambiguity.

the relevant literatures will be reviewed separately below.

5.2.1 (a) Young children's detection of anomalies

Two studies of young children's ability to detect anomalies in representational materials have been previously identified (in Section 1.2). The relevant investigators (that is, Segers, 1926 a and Vurpillot, 1962) each supposed their studies to have found that young children do not identify pictures of objects on the basis of a co-ordinated perception of the component parts. In particular, Vurpillot (1976 b) regards her later study (op.cit.) as having confirmed the validity of the early observations of Cramaussel (1924) and Segers (op.cit.) that before seven-years or so -

> "children have a tendency to identify an object or its representation according to a single cue, neglecting to verify the truth of the hypothesis by examining other parts of the picture (p.214, 215)."

The present contention is however that these conclusions are not warranted. Specifically, each of the two studies has a number of limitations which should be noted. Consider first the study conducted by Segers (op.cit.). Segers presented his subjects with five monsters, each monster comprising a head and a body from two different types of animal. (Segers provides no details concerning the manner in which these monsters were presented; Segers' subjects do not, however, appear to have been informed as to the possibility of the stimuli being anomalous.) Segers' results are reproduced in Table 16.

The first thing to notice is that none of the children in the two younger age groups (that is, those aged three-to-seven years) successfully identified a single monster as monstrous. The great majority of these younger subjects identified the monsters on the basis of either the head or the body part.[3] Segers, however, suggests that these results indicate that three-to-five year olds base their identifications upon the body part and that, after five-years, the identity of the head part tends to dominate the identifications made until sometimes seven-years, but typically nine-years when children begin to evidence appreciation of the anomalies presented. It has previously been noted that Segers equates ident-

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[3] N.B. A negligible number of subjects named the monsters (in non-anomalous terms) as portraying a different type altogether; these subjects have been omitted from Table 16.

Table 16 Numerical breakdown of how children of various ages identified five monsters (results obtained by Segers, 1926 a).

Age (years)	Monsters[1] and nos. of different identifications made for each: Cat-Dog			Dog-Cat			Cow-Horse			Cow-Horse			Horse-Cow		
	cat	dog	cat+dog	dog	cat	dog+cat	cow	horse	cow+horse	cow	horse	cow+horse	horse	cow	horse + cow
3-5	15	5	0	16	2	0	7	10	0	4	16	0	9	11	0
5-7	16	3	0	20	0	0	13	3	0	10	9	0	8	12	0
7-9	18	2	0	20	0	0	18	1	0	14	5	1	17	2	1
9-12	16	2	12	10	14	7	16	3	10	15	3	13	7	7	15

(1) N.B. For each monster, the identity of the head part is given first. For example, the monster 'Cat-Dog' comprised a head of a cat on the body of a dog. This reference scheme for such monsters will be used in the text for the remainder of this chapter. It is apparent that Segers presented two monsters with a cow's head and a horse's body (monster columns three and four, respectively); the difference between these stimuli was that in one case the body was in a walking posture whilst in the other it was in a galloping posture. Unfortunately, Segers does not indicate which of these results columns is which. It seems most likely however, that the results in column three above are the results obtained with the galloping body and that the results in column four are those obtained with the walking body.

ifications that are based exclusively upon a body part, with a focusing of attention on the 'general look' of the monster; consequently, Segers concluded that these results are consistent with the syncretist position concerning young children's limitations when making identifications (cf.,Section 1.2). These conclusions appear, however, to be wholly inconsistent with the results obtained. It is evident, in particular, that there were in fact marginally more subjects in the three-to-five year old group who named the monsters on the basis of the head parts than who named the monsters on the basis of the body parts. Segers would seem to have considered that this discrepancy may be accounted for by rejecting the results gained with the dog-cat monster on the grounds that,

> "the dog's head adapted itself so well to the cat's body that almost all the children said they saw a dog."(4)

This is a very odd kind of argument to make; for the subjects in Segers' study must surely have based their identifications of the dog-cat monster on the head part rather than upon the body part. Consequently, it seems to be the case that rather than the head being adapted to the body, the body part was in fact assimilated to the head. Segers does not indicate the breed of dog portrayed in the dog-cat monster, however, it does seem quite possible that a cat's body will be sufficiently similar to the body of some breeds of dog for a monster drawing made up of the head of such a dog and a cat's body to be widely accepted as a dog.

There would seem though to be no reason for excluding from consideration the results gained for the dog-cat monster that could not also be invoked for each of the other monsters. What Segers' results appear to show then is that young children base their identifications of head-body monsters upon one of the component parts and that they do not detect the anomalies. There are grounds however, for reasoning that this is not the interpretation which should be given to Segers' results. In particular, there are two factors to which Segers' comments draw attention and which may, potentially, be important. The first of these is that when the

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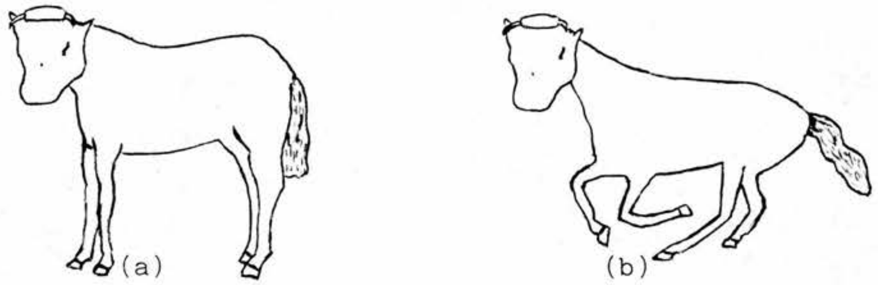
(4) In the original, 'la tête du chien s'adapte tellement bien au corps du chat, que presque tous les élèves ont déclaré voir 'un basset' (p. 749).'

anomalies are very subtle (as Segers' monsters appear to have been) children may lack the detailed knowledge of the type-identity of one or the other of the parts that is required to detect the anomaly. The second possibility is that subjects do not actually lack knowledge of the type-identity of the parts combined but rather they simply fail to notice the most subtle of anomalies because the parts combined are so compatible. It is evident in this regard that the identities paired by Segers were clearly not as blantantly monstrous as other pairings which may be imagined. Upon reflection, a number of elements would seem to be involved in making one anomalous stimulus more compatible than another. One factor involved for example is, in the case of monsters, the posture of the body part. Specifically, a body part is unlikely to be assimilated to a head part if it is in a highly type-distinctive posture even if structurally it is similar to the part which it has been substituted for. Something of this kind of thinking may have underlain Segers' presentation (cf., above, this section) of two horse bodies with the same cow's head. Consider in this regard the two monsters illustrated in Figure 19; these monsters share the same (fairly type-distinctive) cow's head but because cows often stand in a posture roughly equivalent to that adopted by the horse body in stimulus (a) but do not gallop (as in stimulus (b)), the body part which would seem to be most easily assimilated to the

Figure 19 A cow head with posturally compatible and posturally incompatible horse bodies.



head part is the body of stimulus (a). This supposition is supported strongly by the ratings of a group of eighteen first-year psychology students (cf., Appendix G for details); specifically, these students judged unanimously that monster (a) is less bizarre than monster (b), (applying χ^2, $p < 0.001$). It is apparent then that if the subjects in Segers' study lacked the knowledge necessary to spot the anomalies or if, alternatively, they possessed this knowledge but simply failed to notice the anomalies, then children may actually be rather better at detecting anomalies than the results of the study suggest.

Consider next the more recent study of children's ability to detect anomalies which was conducted by Vurpillot (1962). What Vurpillot did was to present each of her subjects with a series of fifty-three cards; on each card was a drawing, either of a sheep or a rabbit (of varying levels of completeness) or of a monster (variously made up of both rabbit and sheep parts). Altogether there were fourteen sheep and fourteen rabbits, more or less complete, plus one further stimulus (the head part alone) which could be either a sheep or a rabbit, plus twenty-four monsters. Each subject was first shown two empty boxes and then given the following instruction:

> "In the pack of cards, there are, mixed up, pictures of sheep and pictures of rabbits. You have to put all the sheep in one box and all the rabbits in the other."[5]

As an example, subjects were then shown two drawings, one of the fully complete (and non-anomalous) sheep (cf., Figure 20. a) and one of the fully complete (and non-anomalous) rabbit (cf., Figure 20. b) and each of these drawings was then put into one of the boxes. Each

Figure 20 The two complete and non-anomalous drawings presented by Vurpillot, 1962 (from Vurpillot, 1976 b).

(a) sheep (b) rabbit

subject was then forced to choose for each of the remaining drawings whether it should be categorised as a rabbit or as a sheep. In treating the results she obtained, Vurpillot classified each picture according to whether, typically, it had been identified as a sheep or as a rabbit or else had not been differentiated as either a sheep

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(5) Literally, 'dans le paquet de cartes, il y a, mélangés, des dessins de moutons et des dessins de lapins. Il faut mettre dans une boîte tous les moutons et dans l'autre tous les lapins (p.148).'

or a rabbit. (A stimulus was classified as having been differentiated as a picture of a sheep or a rabbit respectively, if more than 16 of the 25 subjects made the same categorisation.) Vurpillot appears to have been primarily concerned with establishing the different uses made by children of various ages, of particular features in the identification of sheep and rabbits. What she found was that from about four-years onwards, the rabbit's ears and, to a lesser extent the sheep's wool, were strong cues in eliciting categorisations based upon their respective identities but that more features were taken note of by older children. Specifically, Vurpillot observes:

> "As he (that is the child) gets older, he takes into consideration the existence of all the elements which are at his disposal and this allows him ... to establish a hierarchy among the monsters as more rabbit or more sheep according to the number of characteristics of each type that they have (1962, p. 154)."

Nevertheless, it should be emphasised that throughout the age range Vurpillot studied (that is, 4 - 11 years) a hard-core of some 8-11 monsters remained undifferentiated. In relation to the incomplete drawings, Vurpillot found that, in general, the older the child, the fewer was the number of these drawings which remained undifferentiated.

As previously noted (this section) Vurpillot (1976 b) regards these findings as having confirmed previous observations by Segers and others that young children tend to identify pictures on the basis of single features only rather than upon a co-ordinated view of all the parts. In particular, she argues that because her younger subjects did not reliably categorise the less powerful discriminatory features as either sheep or rabbit, these features are not learnt until later years and that until then, identifications are nearly exclusively based upon a characteristic detail; other details not being taken into account. There are however several grounds upon which it may be argued that these conclusions may be suspect. To begin with it would seem that the characteristics of Vurpillot's design are such that it was only possible to tell that a child failed to identify a feature from whether or not this feature was correctly identified on the incomplete figure in which it appeared in isolation. (This is because it was surely impossible to determine with any certainty that a feature was not being taken into account when the other stimuli in which the feature occurred were categorised.) However, the finding that some of the younger children identified or failed to correctly identify certain of the features in the incomplete drawings does not really demonstrate that these children would not pay any attention to these features in complete pictures. For example, the finding that children do not identify the legs of the sheep (cf., Figure 20.a) when they are presented alone does not indicate that these children would not notice if the legs were omitted in an otherwise complete picture of the sheep. In addition to this, it is also likely that faced with the task of identifying a series of fifty-three cards in a single session as either simply 'a sheep' or else simply 'a rabbit', children would, after a time, lose concentration (and presented with for example, the 'sheep's' legs, there is in fact little reason why this feature should not be identified as a rabbit rather than as a sheep). Thus, rather than indicating how children normally go about identifying objects and/or representations of objects, there is a strong element in this task which taps instead children's ability to learn the identity of certain rather obscure features. Most fundamental, is that surely the best means of assessing whether children attend to each of the various parts in a picture when identifying it is to see if they - as individuals - detect anomalies in respect of each of these parts; this however is precisely what Vurpillot failed to do (since it is not possible to determine whether any of her subjects recognised any of the monsters to be monstrous).

The basic question addressed by the present investigations concerning children's ability to detect anomalies is that of the kinds of head-body anomalies (as in Segers' study) which individual children detect. Since, as has been previously noted, children's knowledge of the type-identity of the parts combined may have a considerable bearing upon their ability to detect monsters involving combinations of these parts, the present investigations will, like Vurpillot's study, involve an examination of children's ability to name the parts separately. Nevertheless, however, it will not be assumed that an inability to name the type-identity of component parts will necessarily incapacitate subjects from being able to detect anomalies associated with these parts; specifically, children may possess knowledge about animals which is at levels of abstraction other than that of type and they may use this knowledge to detect certain more bizarre anomalies. This latter observation relates to what has already been said (this section) in relation to Segers' study concerning the likelihood that the compatibility of the parts combined may affect whether or not monsters are detected, independently of subjects' knowledge of the type-identity of the parts combined. Thus, whilst if the parts combined are highly compatible, children may not notice an anomaly - even if they can correctly identify the type of the component parts when these parts are separately presented - it is also the case that, if the parts combined are highly bizarre, then even children who do not know the type of the component parts may detect the resulting anomalies. The kind of compatibility which was of prime concern in the present investigations was the kind of compatibility which is based upon a structural similarity between different kinds of animals. These similarities it would seem, tend to be based (though by no means always) upon family resemblances; that is, other things being equal, the closer animals are in a biological taxonomy, the more likely it is that equivalent parts will be similar and therefore compatible.[6]

The design envisaged for the present investigations was to compare the relative ease with which children detect a monster with parts judged to be compatible and a monster with parts judged to be relatively incompatible. To assist the clarity with which the results obtained might be interpreted, it was envisaged that the two members of the monster pair to be presented would each share one of the two animal parts (that is either the head or the body). Also of interest though was how the children's ability to detect each of these monsters varies according to whether they know the type identity of both the component parts, the type identity of one part only (that is, the part shared by the two monsters) or whether indeed they know the type identity of neither of the component parts. It is apparent that in order to assign subjects to these various type-knowledge conditions, subjects must first be screened to determine their

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[6] It should be emphasised that the present use of the words 'compatible' and 'incompatible' should not be taken to indicate that these qualities are in any sense absolute; essentially these are relative terms; relative, that is, to other combinations of parts which might be made.

ability to identify the type-identity of the component parts (that is the heads and the bodies). This screening session was conducted before any decisions were made as to the precise monsters to be presented. So that as wide a variety of choice of monsters was available as was possible, and, in particular, so as to maximise the probability that reasonable proportions of subjects would be unable to correctly name the type of animal from which some of the parts were derived, a large number of head and body parts were presented in this session (cf., Section 5.2.2 for details).

5.2.1 (b) Young children's performance with ambiguous figures

In Chapter One (cf., Section 1.2) an implicit distinction was made between composite figures and ambiguous figures. It is evident however that both of these kinds of figure require the recognition of an ambiguity according to the manner in which the stimulus is perceptually organised. Composite figures would therefore seem to be best regarded as a particular kind of ambiguous figure in which the ambiguity always rests in the perception of the discrete elements as against the perception of these elements as an integrated whole. The ambiguous figures with which the present investigations are concerned are the kind of figures in which the ambiguity rests upon two integrated views of the whole. The particular focus of interest is a series of studies carried out by David Elkind and his associates on young children's ability to spot such ambiguities. Examples of the ambiguous figures used by Elkind have already been illustrated in Figure 4 (p. 14). In the first of his studies, Elkind (Elkind and Scott, 1962) found that the perception of ambiguities is more likely the more the component identities are each articulated[(7)] and that the ability to perceive ambiguities increases with age and has a low but positive correlation with intelligence.[(8)] In a later study Elkind (Elkind 1964) collected some normative developmental data for six groups of children ranging in age from six-to-eleven years.

[(7)] Though Elkind and Scott also conclude that when only one component identity in the ambiguous figures was articulated, the remaining identities were less frequently perceived than when both identities were left unarticulated.

[(8)] Elkind and Scott do not indicate which particular intelligence test was used; however, Elkind (1964) reports that the test used was the Kuhlmann-Anderson group test of general intelligence.

Elkind found that his subjects did not generally begin to notice the ambiguities (that is, in more than the odd figure) until about 8:6 years.

Elkind (1969; 1975) interprets these results in terms of Piaget's theory of perceptual development. In the Piagetian view (Piaget 1969; see also Section 1.2) perceptual development is chiefly described in terms of a decline in the efficacy of the processes of primary perception and a corresponding gain in the scope and importance of perceptual activities. Perceptual activities are held to be less passive than the processes of primary perception and Elkind argues that it is the development of perceptual activities which makes possible the spontaneous reorganisation of the visual field that is required for the reversal of ambiguous figures.[9] Thus he concludes (as also does Vurpillot - eg., 1976 a) that young children are lacking in their ability to co-ordinate perceptual information. Now, Elkind's conclusion that the ability to spot ambiguities increases with age (at least insofar as the transition from child to adult is concerned) is probably correct so far as ambiguous figures with fixed component identities are concerned. There would appear however, to be at least two reasons why Elkind may have underestimated the ability of young children to identify pre-set ambiguities in ambiguous figures. The first of these is that, as a whole, the identities in the figures Elkind presented were not very well articulated and that typically, one of these identities tended to be very much more articulated than the others. This is evident from the samples of Elkind's figures which are illustrated in Figure 4 (p. 14). It is especially noteworthy in this regard that in the case of some of Elkind's figures neither of the component identities was recognised by a majority of the children in the youngest age groups[10]; thus, large numbers of children (occasionally more than 50 per cent) failed to recognise either of the component identities. The second factor limiting the value of Elkind's results as a measure of children's ability to spot the ambiguities in ambiguous figures

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[9] Elkind (eg., Elkind and Scott, 1962) contrasts this view with the views of Gestalt psychologists such as Köhler and Wallach who, he says, proposed a neurological model to explain the process of spotting ambiguities. According to Elkind, the Gestaltists predict that the incidence of reversals should decrease with age.

[10] This is apparent from the results presented by Elkind and Scott (see, Elkind and Scott, 1962, Table 3 p. 625).

concerns Elkind's failure to motivate his subjects to attend the figures for a reasonable length of time. It is important to notice that Elkind and Scott are aware of this problem; thus they comment:

> "It might be argued that children in the present study did not attend long enough for .... reversals to occur. This argument cannot be refuted inasmuch as there was no way to insure that the children attended to the ambiguous figures (Elkind and Scott, 1962, p.627)."

In the present view one measure which might be expected to increase subjects' motivation to continue to attend to the figures once an initial identification has been made would be to inform subjects as to the possibility of the stimuli being ambiguous.

There is one other study which has been conducted by Elkind and some of his colleagues which has not yet been mentioned. Significantly, this study (Elkind, Koegler and Go, 1962) constituted an attempt to train three groups of children - of mean age 6:7, 7:7 and 8:7 years respectively - to detect the ambiguities in ambiguous figures. These children were first tested on one set of figures, were then trained on a second set of figures and then finally were re-tested with the original set of figures. The figures used were the same as those presented by Elkind, 1964 (cf., Elkind, 1969) and consequently included the figures illustrated in Figure 4 (p.14). The training which was given involved providing the children with progressively more revealing clues with regard to the component identity (or identities) which had not been detected spontaneously. This process culminated in the hidden identity being named and, if the child still failed to perceive it, the identity which could be seen was then masked out so that the hidden identity was immediately apparent. Elkind et al. found that this training did lead to significantly improved performance by the children in each of the age groups studied. Of particular importance is that they found that the mean number of identities perceived immediately after the training by the youngest group of subjects was in excess of twelve (for seven ambiguous figures). These findings are significant because they indicate that Elkind's other studies (Elkind, 1964; Elkind and Scott, 1962) may provide rather conservative estimates of young children's ability to detect ambiguities. Elkind et als' training study does however have two limitations. The first of these is that the seven figures in each of the two sets of figures which were presented were very similar; specifically, only one of the fourteen figures lacks a face profile whilst three of the figures in each set portray goblets and two of the figures in each set portray trees. In view of these similarities it seems quite likely that the beneficial effects of the training which Elkind et al. report may be restricted only to this very limited range of contents and that their subjects did not actually learn general techniques suitable for detecting ambiguities for themselves. The second limitation of Elkind et als' study is that it was not concerned with the youngest groups of children who might reasonably be expected to detect ambiguities.

The present study is designed to examine the extent to which preschool children are able to detect the ambiguities in ambiguous figures when they are fully informed as to the nature of the stimuli. The figures presented each depicted familiar identities and in the case of one of these figures at least, the component identities were reasonably highly articulated. In addition, it was decided to examine, in an exploratory fashion, whether there is any evidence that preschool children are responsive to practice in the detection of ambiguities.

The manner in which the children were informed of the possibility of ambiguities was to tell them that they were to be shown some "magic pictures" which changed their appearance when they were viewed for an extended period.[11a] Only two ambiguous figures were presented. The first of these (cf., Figure 21, A.i) was a specially drawn, frontally reversing 'house-face' figure. The second figure (cf., Figure 21.A.ii) was the equi-probable version of Jastrow's 'duck and rabbit', reproduced by Fisher (1968). The reason for drawing the 'house-face' figure was that it was considered that none of the established figures (including the 'duck and rabbit') were really ideal for presenting to young children.[11b] Consequently the

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[11a] This is of course untrue since it is the viewer's perceptual organisation of the figure which changes; in addition it should be noted that there is a danger with such a format that subjects will simply wait passively for the picture to change rather than seek actively for an alternative organisation of the stimulus. The present format was however thought to be justified because it does at least seem likely to convey satisfactorily to young children the special character of the figures in terms which they can readily understand and to thereby ensure that the children will continue to attend the figures once an initial identification has been made.

[11b] The 'duck and rabbit' figure was considered not to be ideal because it involves a 'left-right' rather than a 'frontal' reversal. Frontal reversals seem to be more obvious.

presentation of both the 'house-face' figure and the left-right reversing 'duck and rabbit' figure permits children's performance on the new figure and on an established figure to be compared. In addition however, these figures were also selected so as to permit them to be used for the practice experience intended. Specifically, these figures make it possible to expose, immediately below the figures themselves, non-ambiguous extensions of either of the component identities in the figures. Thus, if children fail to spot the ambiguities spontaneously, they can be shown an extension of the

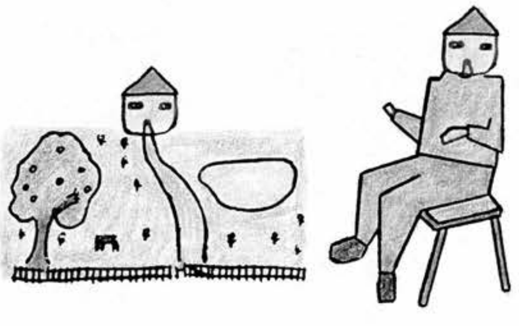
Figure 21 Ambiguous figures and the associated contextual aids presented to children participating in Study Seven.

A. Ambiguous figures (full-size).

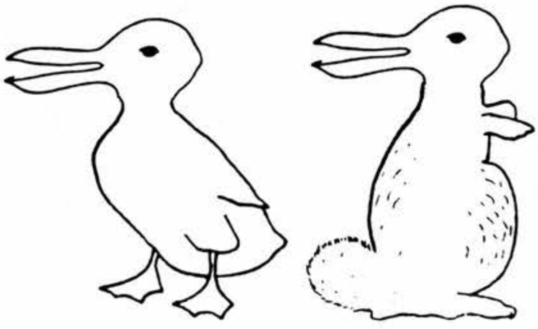
(i) 'House-Face'

(ii) 'Duck and Rabbit'

B. Ambiguous figures with associated contextual aids



(i) 'House-Face'



(ii) 'Duck and Rabbit'

identity which has not been spotted. For example, a child who, having been presented with the 'duck and rabbit' figure, detects the duck but not the rabbit, can then be shown the figure with a rabbit's body in the appropriate position beneath it. Four such unambiguous contextual aids (one for each of the two component identities in each figure) were used in the present study; each of these aids is illustrated (together with the pertinent figure) in Figure 21.B. It is apparent that the use of these contextual aids bears considerable resemblance to the masking techniques employed by Elkind et al. (1962); the present system would, however, seem to possess the advantage that the ambiguous figure itself may be preserved intact throughout the training period.

In relation to the presentation of the unambiguous contexts it should be noted that although the likelihood of Gestalt effects would seem to be such that the presentation of these contexts will aid the recognition of ambiguities, this is not necessarily what will happen and whether it does happen poses an interesting question in its own right. The reasons why the contextual aids may not assist the detection of ambiguities derive from the traditional view (cf., Section 1.2) that preschool children, in attending to objects or representations of objects, will typically centre their attention on particular parts rather than perceive the stimuli as integrated wholes. Indeed, there would appear - theoretically at least - to be a minimum of four possible responses which children who have identified only one of the two component identities might make to the exposure of a contextual aid. The first of these is that subjects may keep their attention centred upon the component identity in the ambiguous figure which has already been recognised; for example, having first identified the 'duck and rabbit' figure as a duck, subjects might continue to affirm, when the rabbit's body is exposed, that the picture as a whole portrays a duck. A second possibility is that subjects may centre their attention on the part most recently exposed and still not fully appreciate the ambiguity of the ambiguous figure part. Thus, having, for example, first identified the 'duck and rabbit' figure as a duck, the whole stimulus (that is, the ambiguous figure plus the contextual aid) might be identified as a rabbit. A third possibility is that the drawing might be identified as consisting of two discordant parts. Thus in the example given above, subjects might continue to affirm that the head is that of a duck but nevertheless, identify the body part as that of a rabbit. Finally, of course, there is the possibility that exposure of the contextual aid might indeed cause subjects to reorganise their perception of the ambiguous part of the figure; that is, subjects may identify the whole figure (that is the ambiguous figure plus the contextual aid) wholistically. Thus, with regard to the example given above, subjects may identify both the 'duck and rabbit' figure and the rabbit's body as portraying a rabbit. Nevertheless, it is apparent that, having done this, children may still be unable subsequently to reorganise their perception of the ambiguous figure alone at will.

The extent to which the contextual aids elicit each of these four kinds of response will yield useful information concerning young children's ability to integrate visual material. It should be emphasised however that if a reasonable number of subjects are not enabled to spot the ambiguities by the contextual aids then this will indicate that the presentation of such aids is not a technique which is suitable for training children in the detection of ambiguities. Piloting for the present study did suggest though, that such contextual aids are likely to produce a fairly large proportion of integrated identifications.

At this point the three main questions which were examined by the present investigations of children's ability to spot ambiguities should be summarised. The first question concerns the number of spontaneous reversals occurring for each of the two ambiguous figures presented and concerns, in particular, whether children spot the 'house-face' ambiguity more readily than the 'duck and rabbit' ambiguity. The second question concerns the number of reversals occurring for each of the two ambiguous figures when children who have not spotted the pertinent ambiguities spontaneously are given an unambiguous contextual aid. Of particular interest is how the number of such reversals compares with the number of other responses which occur. The third and final question concerns whether there is any evidence of a practice effect whereby subjects are more capable of detecting the ambiguity spontaneously on the second ambiguous figure received than they were on the first ambiguous figure received.

It has previously been noted in relation to the present investigations concerning children's ability to detect anomalies that a screening session involving presentation of head and body parts must be carried out before the critical stimuli to be presented can be determined. By contrast, it is clear that there can be no flexibility with regard to the materials to be presented relating to children's ability to detect ambiguities. Nevertheless, the screening session in this study will be used to provide useful information concerning subjects' ability to identify correctly the unambiguous contextual aids to be presented in association with the ambiguous figures. Clearly, if any of these parts are incorrectly named by a large proportion of subjects then this may have serious implications for the interpretation of the results obtained when these parts are presented as contextual aids.

5.2.2 Screening session

5.2.2 (a) Method

Eighty-five preschoolers, 44 boys and 41 girls (mean age 4:4; age range 3:3-5:2), each attending a single nursery class in Edinburgh, were screened. Each of these children was individually presented with a series of 24 drawings. Of these 24 drawings, 4 were the ambiguous figure contextual aids (cf., Figure 22.A) whilst the remaining 20 drawings (cf., Figure 22.B), each portrayed either the head or the body of one of ten kinds of animal and were presented in order to provide for the future presentation of anomalous animals. It should be noted that the majority of the drawings illustrated in Figure 22 (specifically, A3 and B2, B3, B5, B7, B8, B9, B10, B12, B13, B15, B17, B18, B19 and B20) were obtained by decapitating test items of the Columbia Mental Maturity Scale, First Edition (Burgemeister, Blum and Lorge, 1954). The advantage of using drawings obtained from such a test was that the source drawings had been standardised for use with young children.

The E sat opposite each S at a child-sized table and presented the drawings one at a time. The cards upon which the drawings were mounted were shuffled at the beginning of each session so that the order varied. The E began as follows:

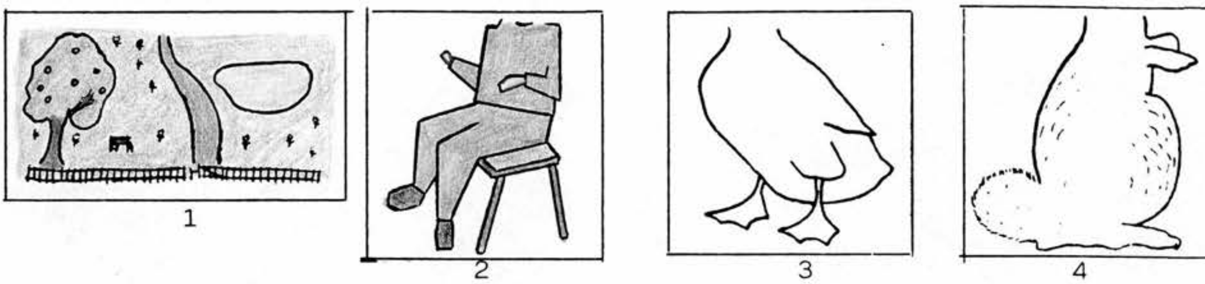
> "Today I am going to show you some pictures (E gesticulates to the cards he is holding). They are rather special pictures because they were drawn by a teddy bear. But do you know what the teddy bear did? .... - he only drew bits of things in the pictures, - he didn't really finish the pictures. What a silly teddy ay! So if I show you the pictures would you tell me what the teddy started to draw? Right then. Let's try this one (E shows the child the first drawing). What do you think the teddy was trying to draw in this picture?"

This latter question was then repeated with regard to each of the 23 remaining drawings with minor alterations from time to time; for example, the E might have asked:-

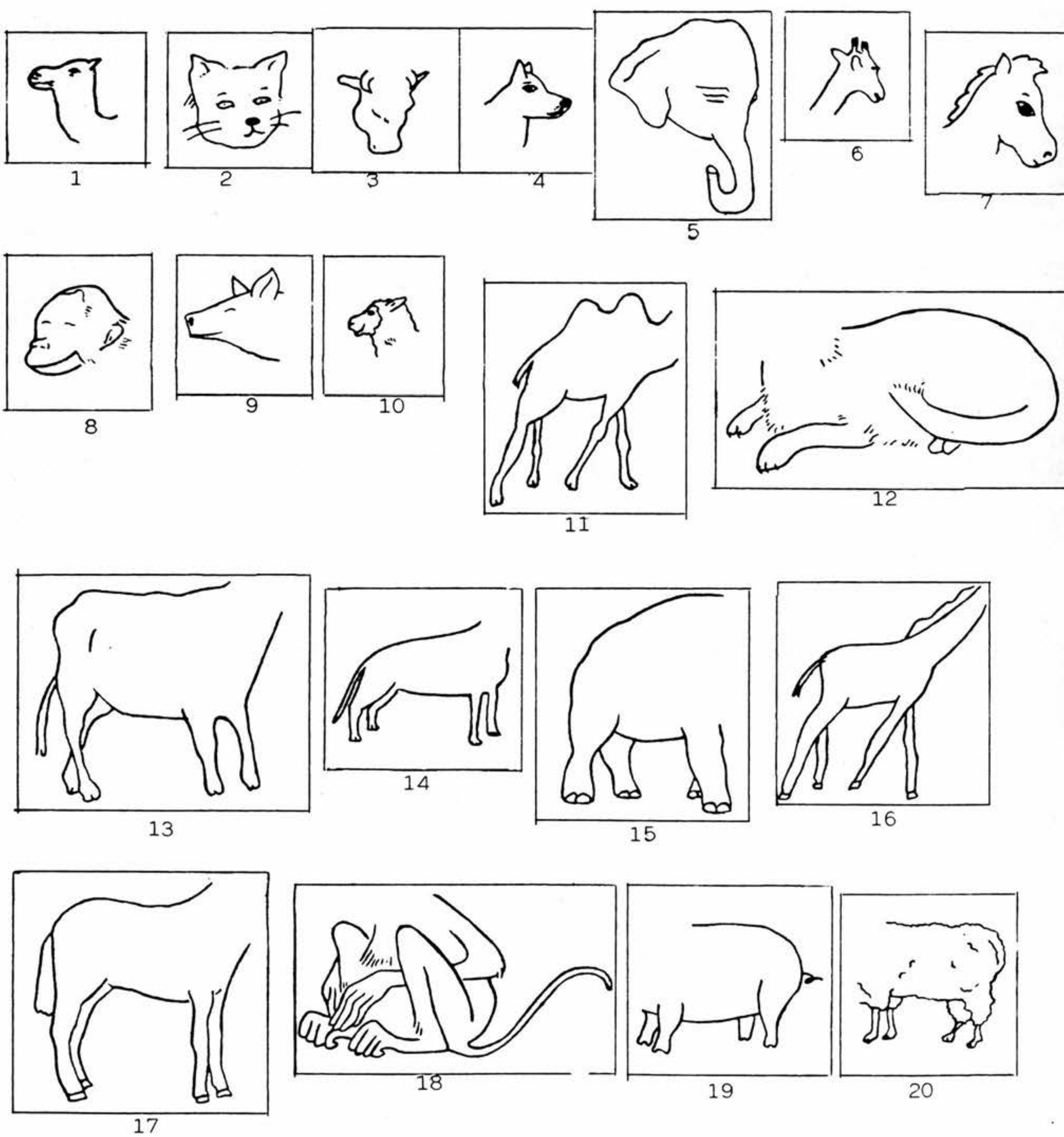
> "and this one? ... What was the teddy starting to draw here?"

Figure 22 Drawings (reduced by half) presented in screening session.

A. Ambiguous figure contextual aids



B. Drawings relating to the presentation of the anomalous animals



At the end of the session, the E spoke to each child as follows:

"So those were the teddy's pictures. He was a lazy teddy wasn't he? Because he didn't finish the pictures did he? Well, when you come the next time I'll bring the teddy. And we can then make sure that the teddy finishes the pictures. We'll make sure that he draws the heads and the bodies. O.K.? And then we can see if he really can draw the pictures properly. So, that's what we'll do the next time."

5.2.2 (b) Results

Table 17 indicates for each of the drawings presented, the percentage of the 85 children making a correct identification. Included for comparative purposes is the percentage of correct identifications made by a group of adults for each drawing (see Appendix G for details concerning the collection of the adult data). The children proved to be far more knowledgeable as to the type-identity of the drawings than had been anticipated. The mean number of correct identifications the children made (out of 24) was 17.85 (range 3-24; median 20). This compares with an adult mean score of 22.7 drawings correctly identified (range 21-24).

It should be noted that in scoring these responses, identifications were held to be correct so long as the the correct genus was cited (or appeared to have been cited). In cases where, for example, Ss identified a horse part as a 'pony', a dog part as a 'wolf' or an elephant part as an 'Indian elephant', the responses were scored as correct. The scoring used in regard to three items merits particular attention. First, several Ss - children and adults - identified one of the horse parts as a donkey (this happened both for the horse head and for the horse body; cf., Figure 22.B.7 and Figure 22.B.17 respectively). This response was scored as correct. Second, with regard to the duck body (cf., Figure 22.A.3) the responses 'goose' (used by one adult and two children) and 'bird'were scored as correct whilst the responses 'pigeon' and 'chicken' were scored as incorrect. Third, in respect of the drawing of a garden (cf., Figure 22.A.1, since only very rarely did either adult or child Ss name it as a 'garden', responses were scored as correct so long as they indicated that an outdoor scene was portrayed. Details of all the identifications made by both the adults and the children of the screening task drawings are given in Table A in Appendix G.

Table 17 Percentage of children and adults respectively correctly identifying the genus of the identity portrayed in each drawing.

Drawings pertaining to presentation of anomalous figures						Ambiguous figure contextual aids		
Head Parts	Per cent correct children	Per cent correct adults	Body Parts	Per cent correct children	Per cent correct adults	Parts	Per cent correct children	Per cent correct adults
camel	66	100	camel	74	100	garden	99	100
cat	100	100	cat	18	72.2	man's body	98	100
cow[1]	81	100	cow	59	100	duck's body	94	100
dog	79	100	dog	39	88.8	rabbit's body	59	50
elephant	74	88.8	elephant	73	100			
giraffe	65	100	giraffe	72	100			
horse	92	100	horse	83	100			
monkey	91	100	monkey	65	94.4			
pig	49	77.7	pig	89	100			
sheep	82	100	sheep	92	100			

(1) Notice that the pertinent drawings in Figure 22 (that is, B.3 and B.13 respectively) portray not a cow but rather a bull. However, the majority of adult and child Ss respectively named both of these parts as those of a cow. It would appear that, in this case, the name which is strictly applicable only to the female of this type is widely used as the type name.

5.2.2 (c) Implications

As previously indicated, it was the proposed investigation of children's ability to spot anomalies that was most dependent upon the outcome of the screening session. In deciding upon which anomalous stimuli to present, the first requirement was for animal parts which a reasonable proportion of the children failed to identify correctly (cf., Section 5.2.1(a)). It is apparent from the results obtained that the parts available were the heads of the dog, elephant, giraffe and pig and the bodies of the cat, cow, dog, elephant, giraffe and monkey. The requirement of the preferred design (cf., Section 5.2.1 (a)) was for two monsters which share one part (either the head or the body) but which differ with regard to the remaining part such that one monster comprises a more compatible combination of parts than the other. In addition, the preferred design requires that each monster be presented to three groups of subjects; one group knowing the type identity of both parts, the second group knowing the type identity of one part only (that is, the part shared by the two monsters) and the third group knowing the type identity of neither part. In the event, however, the present results do not make such a design possible. In particular, no single pair of monsters could be devised which could be presented both to a reasonable number of subjects who knew the type identity of none of the component parts and also to a reasonable number of subjects who knew only the type identity of the part shared by the two monsters. Instead of presenting a single monster pair it was therefore decided to present the three monster pairs shown in Figure 24, C (p.188). Each of these monsters was presented to one or two subject groups as indicated in Figure 23. Thus, the horse monsters and the camel monsters were each presented to subjects who knew the type-identity of both of the relevant parts and also to subjects who knew the type-identity of the shared part only (that is, the horse head and the camel body respectively) whilst each of the pig monsters was presented solely to subjects who knew the type-identity of neither of the relevant parts.

The presentations just described permit nine comparisons to be made statistically. Four of these comparisons are concerned with whether subjects who know the type identity of only one part are less able than subjects who know the types of both parts to recognise

Figure 23 Subject groups receiving the six critical anomalous stimuli in Study Seven.[1]

Monster Stimuli	Subject groups: Know type-identity of both parts	Know type-identity of one part only	Know type-identity of neither part
Horse-Cow	✓	✓	
Horse-Monkey	✓	✓	
Giraffe-Camel	✓	✓	
Dog-Camel	✓	✓	
Pig-Cow			✓
Pig-Monkey			✓

(1) These subject groups are indicated by ticks. The arrows indicate the comparisons of interest; these comparisons are discussed in the text below.

the horse-cow, horse-monkey, giraffe-camel and dog-camel monsters respectively. Of some interest here is whether the performance differentials between these two knowledge groups are affected by whether the stimulus parts are compatible or relatively incompatible. The four pertinent comparisons are indicated by horizontal arrows in Figure 23. The remaining five comparisons are concerned with whether the relative compatibility of the parts combined to form each monster influences the probability of these stimuli being detected as monsters independently of subjects' knowledge of the type identity of the component parts. The strength of this effect can be assessed separately for subjects who know the type identity of both parts, for subjects who know the type identity of one part only and for subjects who know the type identity of neither part; these five comparisons are indicated by vertical arrows in Figure 23. It should be noticed that because it was decided to control for the subject groups pertaining to each of the nine comparisons, the number of drawings correctly identified on the screening session[12] and the mean age and age range, it was necessary to have two subject groups for the majority of the categories of subject group indicated in

(12) It seemed advisable to control for subjects' overall knowledge of type-identity because otherwise the comparisons as to whether knowledge of the type-identity of particular parts affect the likelihood of monsters being detected might have degenerated into comparisons between subjects who were generally competent at judging type-identity and subjects who were relatively incompetent at judging type-identity.

Figure 23. Full details of the characteristics of each of these subject groups are given in Appendix H.

It will be apparent that the comparisons which have been cited in relation to the camel monster pair are precisely the same as those identified in relation to the horse monster pair. The main reason for presenting both of these monster pairs was that there is a considerable similarity between the horse monster pair and the pig monster pair arising from the cow and the monkey body parts that are shared by the members of these pairs. The camel monster pair was therefore included to provide more variety and to decrease the likelihood of the occurrence of order effects; see Section 5.2.3 (c) ii for details of the measures taken. It should be observed here though that whereas the shared part in the camel monster pair is the body part (this part being hypothesised to be the relatively dominant part in the case of the 'compatible' camel monster - cf., Figure 24, C (j) p.188), the shared part in the case of the horse and pig monster pairs respectively is the head part.

One very important consideration is whether adults judge the relative compatibility of the members of the three monster pairs selected to be in the direction hypothesised. In this regard it should be noted that a study conducted with eighteen first-year psychology students found (cf., Appendix G for details) that these subjects judged the horse-cow monster to be less bizarre than the horse-monkey monster (applying χ^2 for one sample case, $p < 0.001$) and the pig-cow monster to be less bizarre than the pig-monkey monster (applying χ^2, $p < 0.001$). When however, these same subjects were asked to judge the relative compatibility of the giraffe-camel and the dog-camel stimuli, they were not found to consider the giraffe-camel to be less bizarre at a comparably significant level (applying χ^2, $p < 0.1$; approaching 0.05).[13]

It has previously been intimated (cf., Section 5.2.1 (b)) that the design of the ambiguous figure study was not dependent upon the outcome of the screening session. The screening session data does however provide useful information concerning the children's knowledge of the type-identity of the unambiguous contextual aids to be

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(13) N.B. The precise chi-square value obtained was 3.555. The chi square value indicating a probability of 0.05 (two-tailed test for two degrees of freedom) is 3.84.

presented in the main experimental session. It is evident from Table 17 (p.183) that these contexts are largely identified correctly. The single exception is that of the rabbit body which was not generally identified correctly. This finding will prove to be of some importance for the interpretation of the main results (cf., Section 5.2.4 (b)).(14)

5.2.3 Method

5.2.3 (a) Subjects

Of the 85 children participating in the screening session, 72 (35 of them boys) were presented with monster stimuli and also with the ambiguous figures. The mean age of the selected group of children was 4:3 years (range 3:3 - 5:2).

5.2.3 (b) Materials

As previously noted, the monster drawings which were presented in this study are illustrated in Figure 24:C. Several other drawings were presented in association with the monster stimuli. Specifically, two drawings of transport vehicles (cf., Figure 24:A) were invariably presented as exemplars and up to five accurate drawings of different kinds of animal (cf., Figure 24:B) were presented as distractors. In relation to the drawings illustrated in Figure 24, it may be observed that neither the head of drawing (c), nor any of the parts comprising drawings (a), (b), (f) or (g) were presented in the screening session. Excluding drawing (b), these additional drawings were each obtained from the Columbia Mental Maturity Scale, First Edition (Burgemeister, Blum and Lorge, 1954).

The ambiguous figures and the drawings used in connection with the presentation of these figures have already been both described and presented (cf., Section 5.3.1 (b) and Figure 21 p.177 respectively). It should be noted however that the two contextual aids for each figure were mounted one on top of the other, each on a separate flap (hinged vertically). The uppermost contexual aid on each card was covered with a plain white flap.

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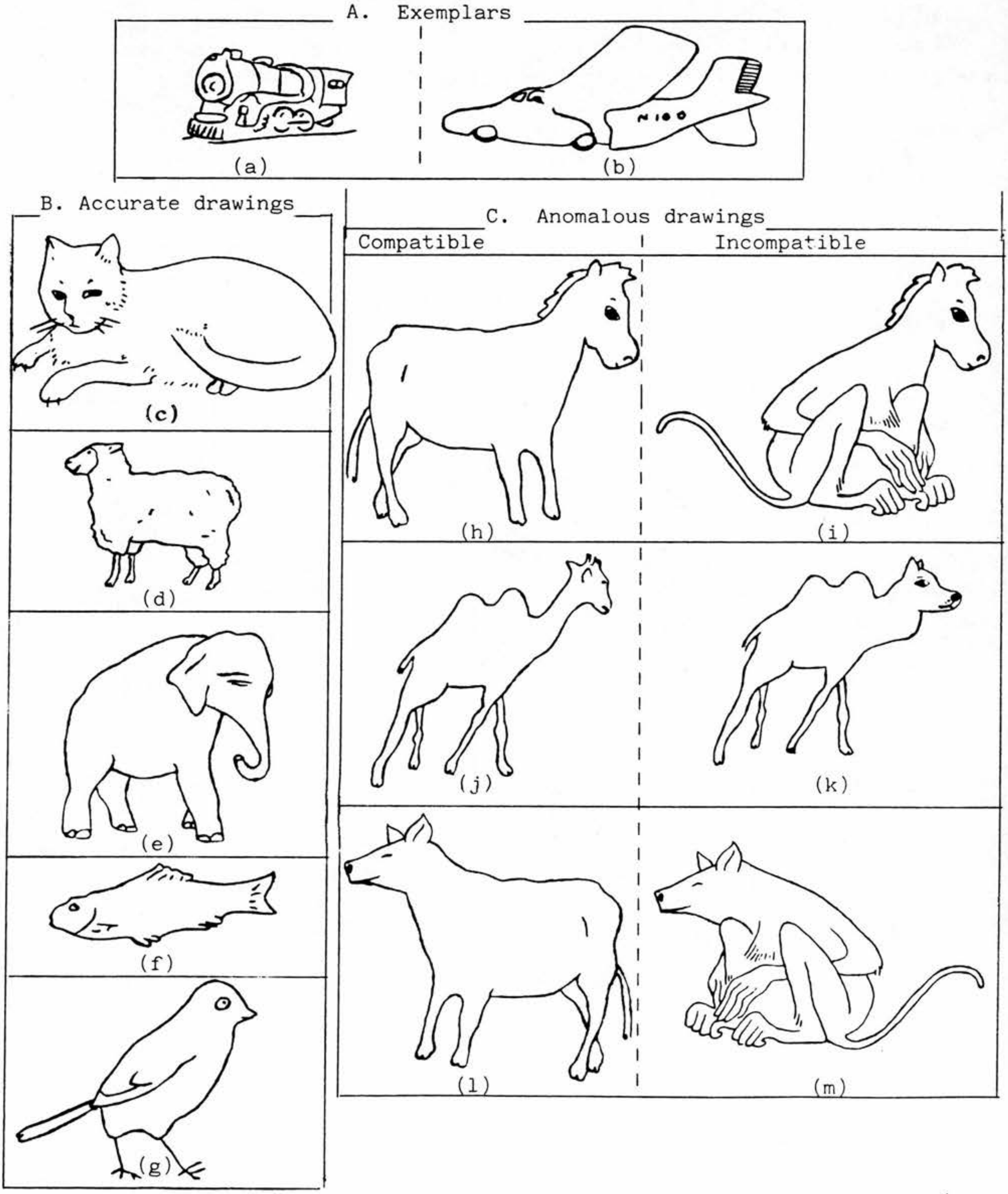
(14) Individual subjects were not dropped from the study at this stage on the basis that they failed to identify the rabbit body correctly, because there was no guarantee that they would, in any case, be required to be shown the rabbit body.

Each of the stimuli presented in the study were drawn on a white card. The E sat opposite each S at a child-sized table covered with white paper. A teddy bear, seated in an appropriate sized 'high-chair', was positioned next to the E.

Figure 24 Anomalous drawings and drawings presented in association with the anomalous drawings (reduced by half).



5.2.3 (c) Design

5.2.3 (c) i General features

Each S was shown the predesignated anomalous drawings (together with the associated exemplars and distractors) before the ambiguous figures were presented. Once selected for the anomaly detection task, each S automatically participated in the ambiguous figure study as well. As previously indicated (cf., Section 5.2.2 (c)), the selection of Ss for the anomalous drawing task was constrained by the requirement that the Ss selected should permit nine comparisons to be made between groups of Ss with varying knowledge of the type-identity of the critical monster parts. In addition, it was required for each of these comparisons (cf., Section 5.2.2 (c)) that the number and age of Ss and also the number of drawings which they correctly identified on the screening session, should be controlled.

Each S received the anomaly and ambiguity detection tasks in a single session. The mean interval between the screening session and the second session was 21.8 days (range 14 - 27 days).

With regard to the selection of Ss for the anomaly detection task it should be further noted that the method followed was to use, for each statistical group, as many of the 85 Ss who were screened as was possible, up to a limit of 20 Ss per group. Because however, of the factors controlled for between these groups and also because of a general shortage of Ss in the relatively unknowledgeable groups (unknowledgeable that is as to the type-identity of one or both of the component parts), this limit of 20 Ss was reached only in the case of one pair of statistical groups.(15) It should be noted in relation to the assignment of Ss to the statistical groups in which Ss were unknowledgeable as to the type-identity of one or both of the component parts that no S was assigned to such a group if he or she wrongly identified a pertinent part on the screening test as belonging to one of the types of animal with which it was to be combined to form a monster. Such identifications were particularly

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(15) The minimum number of Ss in these statistical groups was 9 and the mean number of Ss in these groups was 14. As previously noted, full details of all the statistical groups are given in Appendix H.

marked in the case of the cow body;[16] specifically, 14 Ss wrongly identified the cow body as the body of a horse on the screening test. Clearly, an investigation of the effect of knowledge of the type-identity of the parts combined upon the ability to detect discordances would have been severely prejudiced if these Ss had been entered into the type ignorant group for this stimulus. (That is, because Ss who wrongly identified the cow body as the body of a horse would be seemingly bound to accept the 'horse-cow' monster as a valid picture of a horse, such a result would not indicate anything about the power of a known part to determine the interpretation of an unknown part.)

Concerning the presentation of the two ambiguous figures, the order in which these figures were presented was counterbalanced. Specifically, for the presentation of these figures, the 72 Ss were subdivided into two groups of 36 Ss and the Ss in each group received the figures in the reverse order. For both groups, the mean age was 4:3 years and the mean number of drawings correctly identified on the screening session was 18. In addition, the age range, the range in the number of drawings correctly identified on the screening session and the sex composition of each group was balanced.[17]

The remaining features of the design of the anomaly detection task are considered in the next section. The remaining design features of the ambiguity detection task are given in conjunction with the description of the relevant procedures (cf., Section 5.2.3 (d) ii).

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(16) The only other such identifications which occurred were as follows: one S said the monkey body was a horse's body, three Ss identified the giraffe head as that of a camel and nine Ss identified the pig head as a cow's head. The relatively large number of Ss who identified the cow body as a horse's body and the pig head as a cow's head does serve to emphasise just how compatible are the horse-cow and pig-cow monster combinations.

(17) Specifically, the group receiving the 'duck and rabbit' figure first, comprised 17 boys and 19 girls, had a range in the screening session identification scores of from 8-24 correct identifications and had an age range of 3:3-5:2 years. The group receiving the 'house-face' figure first comprised 18 boys and 18 girls, had a range in the screening session identification scores of from 8 to 23 correct identifications and had an age range of 3:4-5:1 years.

5.2.3 (c) ii Anomaly detection task

The requirement of the task as it was described to the Ss receiving it was to decide whether drawings constructed (ostensibly) by the teddy from the heads and the bodies presented on the screening task had been put together correctly or not. To assist the Ss to appreciate that they were required to differentiate accurate from errant drawings, Ss were shown first the two exemplars illustrated in Figure 24.A. Of these exemplars, the accurately drawn train was invariably presented first. In those few cases where the car-plane anomaly was not spotted spontaneously, this error was pointed out. The rationale for using inanimate rather than animate exemplars was that Ss would not then be given any indication of the degree of monstrosity which they might expect. After being presented with the two exemplars, individual Ss then received anything from two-to-five of the monsters. Having determined the number of monsters each S was to receive (this allocation was based upon the groups to which each S had been assigned - cf., Sections 5.2.2 (c) and 5.2.3 (c) i), each S received an equivalent number of non-anomalous drawings. To determine which of the non-anomalous drawings were presented, these drawings were simply placed in a fixed series (this series was from drawings (c) to (g) respectively in Figure 24.B) and the required number of drawings was then selected by starting with the drawings at the top of the series and ending with the last. (Thus, drawing (c) was always selected first and drawing (g) last.)

The order in which Ss received the selection of monsters and non-anomalous drawings which they had been allocated was varied. It was however contrived that monsters which shared a part in common were not presented in such an order that they followed each other directly. By preventing the occurrence of these order sequences it was considered that the likelihood of gaining independent judgements for each monster would be maximised.

5.2.3 (d) Procedures

5.2.3 (d) i Anomaly detection task

For each S, the E, holding the appropriate drawings in the predesignated order (the drawings were not initially visible to the Ss) began as follows:

"Well, I said that I was going to bring the teddy-bear didn't I? - And here he is (E gesticulates in the direction of the teddy). Now, the last time that you came I showed you some pictures that the teddy had made didn't I? And do you remember? - He didn't finish the pictures did he? - He either drew just the heads, or he drew just the bodies (E pauses). Well today, teddy has got some more pictures to show you. And this time he has drawn the heads and the bodies. But do you know what? - Sometimes he's put the wrong heads with the wrong bodies! - he hasn't put the right bits together! So we're going to look at the pictures and see which ones teddy has put together in the right way and which ones teddy has put together in the wrong way. And if we find one that he's got wrong would you tell him? So, let's see the first picture. So what about this one then. Has teddy put the right bits together or the wrong bits together - what do you think?"

The E then presented the drawing of the train. If Ss indicated that they thought the right bits had been combined but failed to say what they thought it was a picture of, they were asked: "Well what is it a picture of then?"; all Ss making such a 'right bits' judgement were then additionally asked:

"How do you know it's a ________ (ie., name given by S)? Because it's got what ....? Because it's got ......?"

If alternatively, Ss indicated that they thought that the wrong parts had been combined but failed to say what they considered that the parts were, they were asked to be more specific, for example, a S might have been asked: "What's he done wrong then ... what are those bits?"

When the questioning relating to the first drawing had been completed, Ss were presented with the anomalous practice example, and then with the experimental monsters. For each drawing the critical question was repeated - that is,

"has teddy put the right bits together or the wrong bits together - what do you think?"

- and the same justification questions were asked as appropriate.

It has previously been noted (cf., Section 5.2.3 (c) ii) that only for the two exemplars (cf., Figure 24.A p.188) were Ss given any assistance if they failed to give correct replies. In relation to the train drawing, a few Ss did indicate that they thought the teddy had erred in producing such a drawing (for example, one S complained that the train wasn't quite on the track); in such cases it was explained that the offending part was not actually an error since the teddy had at least put the right bits together. For these Ss too the relative severity of the error in the car-plane drawing was stressed when it was presented. Alternatively, a few Ss correctly accepted the train drawing as non-erroneous but were unable to provide a satisfactory justification for their acceptance of the drawing. In such cases, the E gave an appropriate justification as an illustration; for example:

> "You can tell that's a train because it's got train wheels and look, it's going along a railway track."

In relation to the car-plane exemplar, there were a few Ss who failed to notice the anomaly.(18) For these Ss the E would say something like:

> "But look, do you see what the teddy has done? (E then covers up each part of the drawing alternately.) He's drawn part of a (E pauses) car (yes that's right(19)) and he's drawn part of an (E pauses) - (yes part of an) aeroplane and he's put them together. So those are the wrong bits aren't they? What a silly teddy!"

5.2.3 (d) ii Ambiguity detection task

When Ss had received all the anomalous or anomaly associated drawings which they had been allocated, they were given a break of a few minutes and were then briefed with regard to the presentation of the ambiguous figures as follows:

> "Now there are just two pictures left. But these ones are rather special pictures. And do you know why they are special? - they are special because they are magic pictures. And the magic is that when children look at the pictures they sometimes see different things. They look at the picture and they see something but then, when they're looking at the picture, the picture changes into something else. And then, while they're watching, it changes back into what it was before ... and it keeps on changing ... that's why they're magic pictures - because they keep on changing.(20) So would you like to see one? Now, part of the picture is

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(18) Invariably these Ss identified the drawing as that of an aeroplane. It should be noted that strictly speaking this drawing is not anomalous since it is a drawing of a permissible real world object. As indicated above however, the great majority of Ss readily identified this drawing as anomalous.

(19) N.B. The E included such supportive remarks if a S correctly identified the part cited.

(20) This is of course strictly untrue (cf., footnote no. 11 p.176 for comments on this aspect of the procedure).

> covered up but you can see the magic part. So you look very hard at the picture and tell me exactly what you see. O.K. there it is."

At this point the E showed each S the first picture - with the unambiguous contexts concealed - that he or she had been allocated to receive. The E held on to the figure to ensure that the unambiguous contexts remained concealed. In all but a single case, Ss named one of the identities immediately or almost immediately. The E then asked Ss to identify a single feature of the drawing. The features used were the windows/eyes in the case of the house-face figure and the beak/ears in the case of the duck and rabbit figure. The E simply pointed to the relevant feature and asked: "What's this bit then?" Once the part had been named, Ss were asked:

> "Right, now keep on looking at the picture and see if you can see anything else. What else could it be if it isn't a ______ (ie., type name of identified identity)?"

Occasionally, a S complained at this stage, - eg., "but it isn't changing." For these Ss the E replied:

> "Well actually the picture doesn't change but you should be able to see something else there. What could the picture be if it isn't a _______ (ie., type name of identified identity)?"

The E waited until the S either discovered the second identity in the figure or else started failing to attend the figure (the children's attention span lasted anything from 1 - 3 minutes or so but typically lasted considerably less than 2 minutes). If a S did spontaneously recognise the ambiguity in the figure, he or she was then requested to name certain features of the figure, firstly for the identity most recently discovered and secondly for the identity originally perceived. These features are shown in Figure 25. Those Ss who could name all the relevant features correctly plus those Ss

Figure 25 Features of the ambiguous figures which subjects were asked to identify.

Figures	Identities	Features
House-Face	house face	windows; door; roof eyes; nose; hat
Duck-Rabbit	duck rabbit	beak; direction of gaze ears; direction of gaze; nose

who correctly identified all but one feature were scored as having succeeded in spotting the ambiguity spontaneously and were then presented with the second ambiguous figure.[21a] Those Ss however who, according to the aforementioned criteria, failed to detect the ambiguity of the figure spontaneously, were then shown the unambiguous context which complemented the identity in the figure which had been least well (or not at all) apprehended. The procedure followed for these Ss was thus:

> "O.K. Well now I'm going to show you the rest of the picture. Allright? And when I've opened it (that is, the flap) would you tell me, - has teddy put the right bits together or has he put the wrong bits together? (The E then exposed the appropriate context.) So then, what do you see there? You tell me."

What happened next depended upon the nature of the children's replies. If a S perceived the two parts (that is, the ambiguous figure and the unambiguous context) as conflicting then he (or she) was not questioned any further with regard to the figure. If however, a S did appear to perceive the parts as being complementary and did therefore seem to perceive the second identity in the ambiguous figure, then the extent of his perception of it was determined by questioning him as to what various features of the drawing were. This questioning began with certain features of the unambiguous context (cf., Figure 26) and then progressed to the features of the

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[21a] Occasionally, Ss who were asked to name one or more features for one identity of an ambiguous figure, named such features in terms of the other identity represented in the figure. For example, a S may have identified the house-face figure as a house but then named the windows as eyes. In such cases, the E waited until all the parts had been named and then asked a question such as: "So these are eyes are they? But houses don't have eyes do they? What could these be if this is a picture of a house?" Alternatively, Ss sometimes identified a feature in terms of an identity which they had not yet named or which they could no longer recall. In such cases the E would ask questions of the following form: "You said those could be eyes didn't you? So what could this be (E gesticulates to figure) if those are eyes? ... What could it be a picture of?" The rule in this questioning was not to introduce any information concerning the identities of the figures or the features of the identities in the figures which the S had not himself initially pointed out. If, as a consequence of such questioning, Ss demonstrated that they could recognise the ambiguities in a figure and identify all or all but one of the pertinent features correctly when asked, they were scored as having detected the ambiguity.

Figure 26 Features which subjects identifying fully exposed drawings as non-anomalous were asked to name in the unambiguous contexts.

Figures	Contexts	Features
House-Face	garden man	tree; pond feet; arms
Duck-Rabbit	duck rabbit	feet; wings tail; legs

relevant ambiguous figure (cf., Figure 25). In this way it was possible to determine what precisely each S saw and, in particular, whether Ss had genuinely reversed their perception of the ambiguous figure or whether rather their identifications were based simply upon the unambiguous context. Where a S correctly identified the features of the ambiguous figure in accordance with the identity complementing the unambiguous context, this context was then concealed once again and Ss were asked for the last time to state the identities contained in the ambiguous figure. The questioning used was of the following kind:

> "So then, what is this (E indicates figure) a picture of? And can you tell me what else it could be. What could it be if it isn't a _____ (E repeats the identity named first by the S)?"

If a S failed at this point to name both identities correctly, the questioning with regard to this figure was discontinued. Where, however the two component identities were correctly named, Ss were asked to name the relevant features for each of the two identities (cf., Figure 25).

Once the procedures relating to the first ambiguous figure had been completed, Ss were presented with the second ambiguous figure. Only the critical procedures relating to whether Ss could detect the ambiguity in the figure spontaneously were repeated in relation to these presentations.

5.2.4 Analysis of results

5.2.4 (a) Anomaly detection task

Besides reporting the results of the present study with regard to this task, the current section also reports some revealing results which were gained by a comparative study which was conducted with adults; as previously indicated the relevant details of the adult study are given in Appendix G. The results of both the study conducted with children and that conducted with adults will be discussed jointly in Section 5.2.5 (a).

5.2.4 (a) i Detection of anomalies by preschool children

The results of the study conducted with preschool children relate to two distinct questions (cf., Section 5.2.2 (c)); first, whether the detection of monsters by children is affected by whether they know the type-identity of both the component parts rather than just one of the component parts and second, whether children's detection of monsters is affected by the relative compatibility of the parts combined independently of their knowledge of the type-identity of the component parts. The results pertaining to these two questions are given in Tables 18 and 19 respectively.[21b]

Table 18 Percentage of children detecting monsters who knew the type-identity of one as opposed to both of the component parts.

Parts Known	Monsters: Compatible		Monsters: Incompatible	
	Horse-Cow (10 Ss)	Giraffe-Camel (11 Ss)	Horse-Monkey (13 Ss)	Dog-Camel (12 Ss)
both	10% [(2)]	64%	85%	92%
one[(1)]	0%	27%	77%	75%

(1) N.B. The part known is either the horse head or the camel body.

(2) These arrows indicate the pertinent comparisons.

Consider first the results shown in Table 18. It is apparent that whilst, for each of the four monsters, Ss who knew the type-identity of both parts were indeed more likely to spot the anomaly than were those Ss who knew the type-identity of only one of the

(21b) As previously indicated, the composition of the subject groups for each of these sets of comparisons varied because of the factors controlled for between the subject groups relating to each set of comparisons (cf., Section 5.2.2 (c)). Consequently, the results reported in Tables 18 and 19 concerning the horse and camel monsters respectively strictly pertain only to the relevant set of comparisons.

component parts, none of these effects are very marked. The strongest effect occurs in the case of the giraffe-camel monster but this result does not attain statistical significance (applying χ^2, $p < 0.2$).

Consider next the results shown in Table 19. These results indicate that for each of the three monster pairs, the incompatible monster is more often recognised to be anomalous than the compatible monster; this effect persists moreover, whether Ss knew the type-

Table 19 Percentage of children knowing the type-identity of both parts, one part or neither part who detected the compatible and incompatible monsters respectively.(1)

Parts Known	Monster Pairs: Horse-Cow (compatible)	Horse-Monkey (incompatible)	Giraffe-Camel (compatible)	Dog-Camel (incompatible)	Pig-Cow (compatible)	Pig-Monkey (incompatible)
both	0% ←20→	70%	60% ←20→	95%	—	—
one	0% ←14→	79%	22% ←9→	67%	—	—
neither	—	—	—	—	19% ←16→	75%

(1) The pertinent comparisons are indicated by arrows. The number of Ss involved in each comparison is given at the centre of each arrow.

identity of both parts or one part only and even persists in the case where Ss knew the type-identity of neither part. All but one of these comparisons attains statistical significance. Thus, the horse-monkey monster is rejected more than the horse-cow monster when Ss know the type-identity of both parts (applying sign test, $p = 0.002$) and when Ss know the type-identity of the horse part only (applying Fisher's method for sign test plus Fisher's exact probability test, $p < 0.01$).[22] Similarly, the dog-camel monster is rejected more than the giraffe-camel monster when Ss know the type-identity of both parts (applying sign test, $p = 0.016$) and the pig-monkey monster is rejected more than the pig-cow monster when the type-identity of neither part is known (applying Fisher's method for sign test plus Fisher's exact probability test, $p < 0.05$). One comparison

(22) N.B. Two of the present comparisons involve both a between-subject component and a within-subject component. Fisher's method was applied in the case of each of these comparisons. The pertinent details are given in Appendix H.

does not quite attain comparable statistical significance. Specifically, the comparison as to whether the dog-camel monster is rejected more than the giraffe-camel monster when only the type-identity of the camel part is known attains a p-value (applying Fisher's exact probability test) of only 0.138. The results obtained with regard to the camel monsters do appear, generally, to be slightly out of line with the results obtained for the other monsters. In this regard, results have already been noted in relation to the figures reported in Table 18 which tend to suggest that the effect of Ss knowing the type-identity of both monster parts rather than a single monster part upon their ability to detect monsters is more beneficial (though not significantly so in statistical terms) in the case of the compatible camel monster than in the case of the compatible horse monster. Possible explanations as to why the results involving the camel stimuli are not completely consistent (or apparently not completely consistent) with the results obtained for the other stimuli will be discussed below (cf., Section 5.2.5 a). In anticipation of the conclusion which will be reached however, it may be noted at this point that the present results do indicate that the presentation of the relatively incompatible monsters was of greater significance in determining that anomalies were spotted than was mere knowledge on the children's part of the particular type-identities of the parts combined to form these monsters. This conclusion receives particular support from the finding (cf., above) that even two groups of comparable subjects who failed on the screening session to identify correctly the type-identity of either of the parts combined to form the pig-cow and the pig-monkey respectively, nevertheless, discriminated the acceptability of these two stimuli in terms of the relative compatibility of the parts.

The finding that the children tended to respond differentially to the compatible and the (relatively) incompatible stimuli independently of their knowledge of the type-identity of the parts combined does indicate that, in general, these children did not centre all their attention upon one of the parts but rather took into account both of the parts. This observation would seem to hold not only with regard to the incompatible stimuli (where the finding that the anomalies were widely spotted obviously indicates that the children paid attention to both the head and the body parts) but also in respect of the compatible stimuli since the very finding that the children widely rejected the incompatible stimuli but accepted the compatible stimuli (each of which share one part with one of the incompatible stimuli) does imply that these children were aware that the parts comprising the compatible stimuli are not so incompatible as the parts comprising the incompatible stimuli. Some evidence that the children who erroneously accepted the compatible monsters did nevertheless take into account the features of both the head and the body parts may be derived from the answers which these children gave to the question:

"How do you know it's a _______ (ie., name given by S)?
Because it's got what ...? Because it's got ....?

An analysis of these justification responses is given in Table 20.

Consider first the justifications given when Ss accepted the horse-cow monster as a bonafide member of the horse family (typically as a horse but occasionally as a pony or donkey - see the footnote to Table 20 for details). For this monster (as for the giraffe-camel monster) the responses of those children who knew the type-identity of both parts (cf., Table 20; results column one) and the responses of those children who knew the type-identity of one part only (cf., Table 20; results column two) seem to be generally comparable. The most striking feature of these results is the high proportion of references to the body parts. A majority of children in each of the knowledge subgroups expressly refer to the body part or to some of its features; indeed, of the references to specific parts, the part which overall is most often cited is not a head part but is rather the tail (which is of course a cow's tail). Now it is evident that the actual identifications of the horse-cow monster as a horse must, in most if not all cases, be based upon the identity of the head part independently of whether or not the head part is actually referred to. The finding that the body part is so widely cited by the children in justification of their identifications does therefore suggest that whilst the identity of the head part is noted the head part is not attended exclusively. Rather, the evidence appears to indicate that the children tended to be globalistic in their approach; that they responded to the drawing in its totality and that they did, in particular, pay considerable attention to

Table 20 Breakdown of the number of times the children cited head and body parts[1] in justification of their acceptance of the compatible monsters.

Parts Cited	Horse-Cow: both parts known (22 Ss)	Horse-Cow: horse part only known (14 Ss)	Giraffe-Camel: both parts known (8 Ss)	Giraffe-Camel: camel part only known (8 Ss)	Pig-Cow: neither part known (9 Ss)
general reference to head	4	3	1	0	4
specific reference to ears	1	0	2	0	1
specific reference to eyes	1	1	0	0	0
specific reference to mane	8	6	–	–	–
specific reference to nose	0	0	0	0	2
total no. of Ss citing head part (and as percentage of total no.of Ss)	13 (59%)	10 (71%)	2(25%)	0 (0%)	6 (67%)
general reference to body	0	2	1	0	1
specific reference to humps	–	–	5	8	–
specific reference to legs (or feet)	3	4	2	0	3
specific reference to tail	14	6	2	0	4
total no. of Ss citing body part (and as percentage of total no.of Ss)	14 (64%)	8 (57%)	8 (100%)	8 (100%)	6 (67%)
total no. of Ss citing both head and body parts (and as percentage of total no. of Ss)	5 (23%)	4 (29%)	2 (25%)	0 (0%)	3 (33%)

(1) The Ss entered for this analysis were all but seven of the Ss who had been allocated to the appropriate statistical groups (that is those Ss whose performance is scored in Table 18 and/or Table 19 respectively, who accepted the pertinent monsters). The 7 Ss who were omitted from this analysis comprised 4 Ss who failed to provide a justification for their identification (each of these four cases occurred in relation to the pig-cow monster - which was only named (as a pig) by one of these 4 Ss), 1 S who named the horse-cow monster as a cow (justifying this identification on the basis of the head part!) and 2, two-part knowledgeable Ss who named the giraffe-camel monster as a giraffe. (One of these Ss justified this identification on the basis of the humps and the other S began to justify this identification on the basis of the head part but then subsequently spotted the humps and detected the anomaly.) Of the remaining Ss - whose responses were entered into the analysis in the table, the identifications made by Ss were as follows. First, in relation to the horse-cow monster, of the 22 Ss who knew the type-identity of both component parts, 20 Ss identified it as a horse and 2 Ss identified it as a donkey whilst, of the 14 Ss who knew the type-identity of the head part only, 9 Ss identified it as a horse, 1 S identified it as a pony and 4 Ss identified it as a donkey. Second, in relation to the giraffe-camel monster, all the relevant Ss identified this stimulus as a camel. Third, in relation to the pig-cow monster, the 9 Ss variously identified this stimulus as a cow (3 Ss), a dog (3 Ss), a fox (1 S), a horse (1 S) and a pig (1 S). It should finally be noted that one of those Ss who first named the pig-cow monster as a dog then suggested alternatively that it might rather be a pig.

whether the parts appeared to be complementary. The justifications obtained when the horse-cow monster was accepted as non-erroneous are not therefore entirely consistent with the traditional views which emphasise that young children tend, when making identifications, to centre their attention upon a single, salient part.

The justifications which were given by the children who accepted the giraffe-camel and the pig-cow monsters respectively as non-erroneous are not as interesting as the justifications which were given in relation to the horse-cow monster. Consider first the parts which were cited to justify having identified the giraffe-camel monster as a camel (cf., Table 20, results columns three and four). It is apparent that Ss were strongly inclined to cite the body parts (and specifically the humps) rather than the head parts; indeed, in the case of those Ss who knew the type-identity of the camel part only, every one of them cited the humps as being the sole basis of their identification. It is not entirely clear as to why the head parts were cited so rarely. It would seem however to be the case that the humps are of very considerable prominence relative to the other parts of the giraffe-camel monster. This prominence probably derives, at least partially, from the relative immediacy with which the humps are recognised to be a type-defining value. Consider next the parts which were cited in justification of accepting the pig-cow monster (cf., Table 20; results column five). It is evident from the footnote to Table 20 that the results scored in relation to this monster comprise Ss who variously identified this monster as being either a cow, a dog, a fox, a horse or a pig. Although however, the head and body parts received an equal number of references, only a minority of individual Ss cited both the head and the body parts and consequently it is not really possible to make general deductions from these justifications concerning whether or not Ss appeared to have attended both head and body parts when making their identifications. It is, nevertheless, interesting to observe in relation to these results that four of the children identified this monstrous stimulus as being a legitimate member of the type of one of its component parts. Since each of these Ss failed to identify both of the component parts when they were presented individually on the screening session, this finding may therefore imply that children will identify parts more accurately if they are placed in the context of another part, albeit an erroneous one, than if they are presented in isolation. Similar insights occurred in relation to the giraffe-camel monster. Specifically, two Ss who correctly identified the camel part but not the giraffe part on the screening session, then identified both parts correctly when they were presented jointly as the giraffe-camel monster (and rejected this stimulus as anomalous[(23)]).

Some consideration should finally be given to the justifications which were given by Ss who rejected the three incompatible monsters. The justifications offered by those Ss who correctly identified the type-identity of both the pertinent parts on the screening session proved to be the least variable. Thus, for the horse-monkey and the dog-camel monsters respectively, the modal justification response of such Ss was simply to identify correctly the component parts. This kind of justification response was overwhelmingly predominant in the case of the dog-camel but, in the case of the horse-monkey stimulus, five Ss did identify one of the parts (for four of these Ss this was the body part) incorrectly.

Consider next the justifications given by those Ss who rejected the horse-monkey and/or the dog-camel monsters respectively but who correctly identified the type-identity of only one of the component parts on the screening session. These children rejected the horse-monkey monster overwhelmingly on the basis that the body part (though variously misidentified) was not a horse's body,eg.,-

> "Wrong! Look! It's got wrong paws. That's (ie., the head) a horsie but that's (ie., the body) a tummy of a tiger."[(24)]

- but by contrast, rejected the dog-camel monster overwhelmingly on the basis of correct identifications of both the component parts.

Consider lastly the interesting case of those Ss who rejected the pig-monkey monster despite failing to identify correctly either of the component parts on the screening test. The majority of these Ss failed to name either of the parts - even erroneously. The comments which these Ss volunteered included the following:

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(23) N.B. A third such S identified this stimulus as anomalous on the grounds that the body was a body of a camel whilst the head was that of a deer.

(24) Two Ss did however identify both parts correctly.

- "That looks funny 'cause it's got a funny head. It's a bad picture. Yes he should draw pictures for the zoo."

- "A silly thing. Wrong bits. Can't remember (that is as to what the bits are)."

- "Wrong bits. I don't know what it is. You tell me?(!)"

The remaining Ss did identify either or both of the parts but only in a single case was a part named correctly. The one insight which did occur concerned a S who named the monster as a pig's head with a dog's body.

In concluding this section it should finally be noted that there was no evidence in the results obtained that, in cases where individual Ss received any of the three monster pairs sharing a single part (that is, the horse, camel or pig monsters respectively), the order in which the members of these pairs were presented had any systematic effect upon the likelihood of either monster being rejected.

5.2.4 (a) ii Detection of monstrous anomalies by adults

The results which are summarised in this section were obtained by a study conducted with eighteen first-year psychology students. Several results of this study have been cited previously (cf., Sections 5.2.1 (a); 5.2.2 (b) and 5.2.2 (c) respectively). The findings reported in the present section concern the results obtained when these students were presented with twelve drawings, one at a time, and asked to decide for each drawing whether the head and body matched or failed to match. The twelve drawings presented comprised the six monster drawings presented in the child study (the results of which have been described in the previous section; cf., Figure 24.C (p.188) for reproductions of these drawings) plus six non-anomalous distractors. Table 21; results column one, indicates the number of students who correctly identified the monsters as anomalous. It is apparent from these figures that whilst each of the three relatively 'incompatible' monsters was detected as monstrous by most if not all of the students, a similar majority of the students did not so identify two of the three relatively compatible monsters. The two monsters in question are the horse-cow and the pig-cow monsters respectively. Thus whereas the giraffe-camel, the horse-monkey, the pig-monkey and the dog-camel monsters were each more likely than not to be spotted as anomalous (applying χ^2, for one-sample case, $p \angle 0.02$; $p \angle 0.01$; $p \angle 0.001$ and $p \angle 0.001$ respectively), the horse-cow and the pig - cow monsters were just as likely to be detected as they were to remain undetected (thus, in the case of the pig-cow monster, applying χ^2 for one-sample case, $p \angle 0.8$ only). In addition it should be noted that

Table 21 Breakdown of the numbers and characteristics of the adults who failed to detect each monster.

Monsters and designated compatibility status(1)	No. of Ss (total 18) failing to detect anomalies	Identifications made by Ss failing to detect anomalies(2)	No. of Ss failing to detect anomalies who correctly identified component parts in isolation
Horse-Cow (compatible)	9	horse	9
Pig-Cow (compatible)	7	cow	6
Giraffe-Camel (compatible)	4	camel	4
Horse-Monkey (incompatible)	0	-	-
Pig-Monkey (incompatible)	0	-	-
Dog-Camel (incompatible)	3	camel	3

(1) That is, the compatibility status designated to each monster in the rationale for the study conducted with preschoolers (cf., Section 5.2.2 (c)).

(2) N.B. The identifications made by these Ss were, for each monster, invariable.

although the dog-camel is not any more likely to be detected as monstrous than is the giraffe-camel, the horse-monkey is more often detected as being monstrous than is the horse-cow (applying sign test, $p = 0.004$) and the pig-monkey is more often detected as being monstrous than is the pig-cow (applying sign test, $p = 0.016$). These findings tend therefore to suggest that the difference in compatibility between the two camel monsters is less than that which occurs between the two horse monsters and between the two pig monsters.

Table 21; results column two, indicates, in relation to those students who failed to detect the monsters as monstrous, what these students supposed these drawings to portray. It is evident that, in each case, the students were unanimous in their identifications. Interestingly, whilst the horse-cow was unanimously identified as a horse, the pig-cow was unanimously identified as a cow; since these two monsters share the same body part, this finding presumably demonstrates how the relative prominence of a particular part may vary according to the part with which it is combined.

Table 21; results column three, shows how the students who failed to spot the anomalies had performed on a task (presented two weeks previously) in which they had been asked to identify each of the parts comprising the monsters in isolation. It is evident from the figures tabulated that in all but a single case, each of these students had previously identified each of the component parts correctly.

The relevance of the present findings for the results of the study concerning the ability of preschool children to detect anomalies is discussed in Section 5.2.5 (a).

5.2.4 (b) Detection of ambiguities by preschool children

There were three questions of interest concerning preschoolers' performance with the ambiguous figures. The first question concerns whether children spot, when unaided, the house-face ambiguity more readily than the duck-rabbit ambiguity (the house-face ambiguity being considered likely to be the more obvious because it involves a 'frontal' rather than a 'left-right' reversal). It is apparent from Table 22 that there were indeed more spontaneous reversals for the house-face figure than there were for the duck-rabbit figure. [25] This difference fails only marginally to attain statistical significance (applying χ^2, $p \searrow 0.05$ just [26]).

The second question concerns the extent to which children who do not spot ambiguities spontaneously are enabled to spot such ambiguities

(25) Where Ss named a figure as depicting an identity similar but not equivalent to one of the identifications intended (specifically, the naming of the face as that of a robot - or even, in one case, as that of a kangaroo, the identification of a church or tower rather than a house and the identification of an ostrich, goose or penguin rather than a duck), these identifications were accepted provided that Ss identified sufficient features (cf., Section 5.3.2 (d) ii) to be scored as having reversed spontaneously. In fact however, there were no Ss who, having named two appropriate identities, failed to name sufficient features to be scored as spontaneous reversers.

(26) N.B. The precise chi square value obtained was 3.6.

Table 22 Numerical breakdown of children's performance on those figures first received.

A. House-Face Figure

unaided reversals	see house only			see face only		
13	23			0		
	- - shown man's body - - - - -			- - - shown garden - - - - - -		
	reverse and also reverse when context covered	reverse but not persisting when context covered	no reversals at all	reverse and also reverse when context covered	reverse but not persisting when context covered	no reversals at all
	17	3	3	-	-	-

B. Duck-Rabbit Figure

unaided reversals	see duck only			see rabbit only		
5	26			5		
	- - shown rabbit's body - - - -			- - - shown duck's body - - - -		
	reverse and also reverse when context covered	reverse but not persisting when context covered	no reversals at all	reverse and also reverse when context covered	reverse but not persisting when context covered	no reversals at all
	8	5	13	5	0	0

by being shown unambiguous contextual aids.

It is evident from Table 22 that there is a marked skew as to the identities in each figure which these children first perceived. Specifically, in the case of the house-face figure, these children unanimously perceived the house rather than the face (applying χ^2, one-sample case, $p \angle 0.001$) whilst for the duck-rabbit figure, these children were far more likely to spot the duck than the rabbit (applying χ^2, one-sample case, $p \angle 0.001$). When they were shown the appropriate unambiguous contextual aid, they generally tended (cf., Table 22) to then reverse their perception of the ambiguous figure. This tendency is not however marked in respect of those children who had, for the duck-rabbit figure, spontaneously identified the duck only. Additionally it is apparent that not all of those children whose perception of the figures was reversed when a context was presented could subsequently reverse their perception of the figure at will when the context was covered up. Nevertheless, in the case of those children who spontaneously detected only the house in the house-face figure and also in the case of those relatively few children who spontaneously detected only the rabbit in the duck-rabbit figure, the predominant response was to reverse the identity perceived upon presentation of the context and then to continue to be able to reverse the ambiguous figure when the context was re-covered. This response tends to dominate the other two responses coded in Table 22; thus applying the binomial test for the children first identifying a house and for the children first identifying a rabbit, $p = 0.002$ and $p = 0.062$ respectively. In relation to those children who spontaneously detected only the duck in the duck-rabbit figure, the explanation as to why such a relatively small proportion of children reversed the identity perceived as a consequence of being shown the unambiguous context would seem likely to derive, at least partially, from the failure of many of these children to identify the rabbit body correctly. To begin with, twelve of those children who were presented with the rabbit body context had failed to identify the type-identity of this part correctly when it was presented in isolation on the screening session. Of these twelve children, seven failed to identify this part correctly when it was presented as a contextual aid and failed therefore to spot the rabbit portrayed in the duck-rabbit figure. Furthermore, of the remaining six children who failed to spot the rabbit identity in the ambiguous figure when the rabbit context was exposed (and who supposedly knew the type-identity of the rabbit body), four children identified the rabbit's body as being that of a squirrel. In sum therefore, eleven of the thirteen children who failed to spot the rabbit identity in the duck-rabbit figure when the rabbit context was exposed, failed to identify the rabbit body context correctly. A second contributor to the greater effectiveness of the duck than the rabbit contextual aid in promoting reversals (besides, that is, the difficulty of identifying the rabbit body) is the relative dominance of the duck identity in the ambiguous figure itself. This dominance made it easier to assist subjects to identify the duck than the rabbit.

One additional point is that, of those subjects who failed to reverse when the contextual aids were exposed (cf., Table 22 for details), the predominant response was to identify the two parts as anomalous rather than to centre on either part and make a unitary identification; indeed, only one S made such a unitary identification.[27]

At the beginning of this section, reference was made to three questions which are the focus of interest in relation to the presentation of the ambiguous figures. So far, only the results pertaining to the first two of these questions have been reported. The third question was concerned with whether there is any evidence that the experience of being shown a contextual aid in association with the first ambiguous figure presented, facilitates the spontaneous spotting of the ambiguity in the second ambiguous figure presented. Table 23 provides a numerical breakdown of the children's performance on each figure as a function of the order in which the figures were received. It is evident that for each figure, the number of

Table 23 Children's performance on those figures received second (with the performance on each figure of those children receiving it first in parentheses).

House-Face figure			Duck-Rabbit figure		
reverse spontaneously	see house only	see face only	reverse spontaneously	see duck only	see rabbit only
21 (13)	14 (23)	1 (0)	8 (5)	24 (26)	4 (5)

children who spot the ambiguity spontaneously is greater when the figure is received second than when it is received first. Whilst, however, this effect is only negligible in the case of the duck-rabbit figure, it is, in the case of the house-face figure much more pronounced. Even so, in statistical terms, the greater number of spontaneous reversals occurring for the house-face for the children who received it second than for the children who received it first, only just achieves significance (applying χ^2, $p \angle 0.05$; one-tailed test).[28] With regard to the interpretation of this result, it should be emphasised however that not all of the children who failed

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(27) N.B. This S identified the duck-rabbit figure and rabbit context as a duck.

(28) N.B. A one-tailed test is justified here on the basis that it would have been unreasonable to have assumed that children's ability to detect ambiguities spontaneously might have deteriorated.

to spontaneously reverse their perception of the figure they received first were enabled to spot the ambiguity in this figure by being shown a context. Moreover, so far as the children who received the house-face figure second was concerned, the number of these children who had not been enabled to recognise the ambiguity in the first figure would seem to have been inflated by the difficulty which many of these children had with identifying the rabbit body (cf., above). Consequently, it would seem reasonable to conclude that the contexts probably had a more facilitative effect upon the children's ability to detect ambiguities than might first appear.

5.2.5 Discussion

The main findings of the present study were firstly that the great majority of the preschool subjects detected the most bizarre anomalies and secondly that a considerable proportion of the children detected the ambiguity in the 'house-face' figure without being given any assistance with regard to this figure. These findings are of some significance since it is fairly widely held (cf., Section 5.1) that young children are not able to detect anomalies and ambiguities. The present study did however find there to be several constraints upon preschool children's ability to spot anomalies and ambiguities. The constraints which were found to be operative in the case of anomalies and ambiguities are discussed separately below.

5.2.5 (a) Detection of anomalies by preschool children (and adults)

There was one factor which was found to limit the children's ability to detect the monstrous stimuli. Specifically, whilst, as has just been noted, the children reliably detected the monsters which were the most bizarre, they generally failed, even when they had previously correctly identified each of the parts combined, to detect the monsters which were (as indicated by adult ratings) less bizarre. It should be noted however that although in percentage terms the three 'incompatible' monsters were each detected much more often than the respective 'compatible' monsters with which they were compared (cf., Section 5.2.2 (c) for details concerning these monster pairs) there was one comparison which failed to gain a level of statistical significance comparable to the rest. This comparison was that for the two camel monsters in the case of those children who correctly identified the type of the body part only on the screening session. The most likely explanation for the relatively low level of statistical significance which this comparison attained would seem to be that this comparison was made on the basis of a fewer number of subjects (at least five subjects fewer) than each of the other comparisons (see Table 19 p.198 for the number of subjects upon which each of these comparisons was based).

In considering the camel monsters it is noteworthy that the study conducted with adults yielded two lines of evidence that the giraffe-camel monster was not as compatible relative to the dog-camel as the horse-cow and pig-cow monsters were in relation to the horse-monkey and pig-monkey monsters respectively. The first line of evidence is that the adults did not identify the dog-camel as being a monster significantly more often than they identified the giraffe-camel as being a monster (whereas they did detect each of the other two 'incompatible' monsters significantly more often than the respective 'compatible' monsters; cf., Section 3.2.4 (a) ii). The second line of evidence is that the adults were not as reliable when rating the giraffe-camel as being a more compatible monster than the dog-camel as they were when rating the horse-cow and the pig-cow monsters as being more compatible than the horse-monkey and the pig-monkey monsters respectively - cf., Section 5.2.2 (c). There was one other feature of the results pertaining to the camel monsters which distinguished them from the results obtained for the other monster pairs. Specifically there was some limited evidence, in the case of the giraffe-camel monster, that children who had on the screening session identified the type of both the pertinent parts, were significantly more likely to recognise the giraffe-camel as anomalous than were those children who had correctly identified the type of only the camel part. Now, as just indicated, the results of the adult study do appear to suggest that the giraffe-camel monster was not as compatible as the two other 'compatible' monsters. It therefore seems that whilst knowledge of the type-identity of both the component parts of a monster was not a powerful influence in enabling children to spot anomalies when the monsters were overwhelmingly compatible (as in the case of the horse-cow and pig-cow monsters) or else overwhelmingly incompatible (as in the case of the horse-monkey and pig-monkey monsters), this knowledge did, in some way facilitate the spotting of a monster of a more intermediary level of compatibility.

The question arises then as to the implications of the present findings for the view espoused especially by Vurpillot (cf., Section 5.2.1 (a)) that young children tend, when identifying objects and representations of objects to focus their attention solely upon specific characteristic details. It is apparent from the present results that preschool children are capable of making identifications which are based upon a much more co-ordinated view of the whole stimulus than Vurpillot suggests. In this regard it has already been observed above (cf., Section 5.2.4 (a) i) that although the present subjects typically failed to spot the most compatible monsters, the finding that they generally spotted the 'incompatible' monsters does indicate that they generally took some account of both the head and the body parts. The analysis of the justifications which the children gave for their identifications has also shown this. Nevertheless, although it is clear that the children did generally take some account of both the head and the body parts before accepting the most compatible monsters as non-anomalous it would also seem to be undeniable that in such cases, one of the parts may be of far greater influence than the other in determining the identification which is made. For example, in the case of the horse-cow monster, these identifications were based exclusively upon the identification of the head part. Since such identifications were predominant even when the children had correctly identified the type of each of the component parts presented separately, it can be legitimately argued that the children must, at some level or other, have been centering their attention upon the identity of the head part (that is because otherwise the anomaly would have been detected). At this point however, the very interesting result obtained when adults were asked to discriminate the monsters from accurately drawn animals should be considered. Specifically, a large proportion of the adult subjects failed to identify what would appear to be the two most compatible monsters (that is, the horse-cow and the pig-cow) as anomalous despite having correctly identified the component parts separately. This finding is very important because it indicates that whilst children may not detect the most compatible monsters it is also the case that a large proportion of adults do not detect them either.(29) Thus whilst children may sometimes base their identifications predominantly upon the basis of a single part rather than both parts, adults may do the same. Both adults and children then apparently allow some of their identifications to be determined by salient features which are generally supported by other features in the stimulus. It should be emphasised, though, that the proportions of adults who detected the compatible monsters were higher than the comparable proportions of the child subjects. The relative superiority of the adults' performance presumably derives both from their being rather more adept at looking systematically for head-body anomalies and from the greater consolidation of their knowledge of the type-identity of the pertinent animal parts. It nevertheless remains that there were considerable qualitative similarities between the abilities of the adult and preschool subjects to detect the 'compatible' (and even more so the 'incompatible') monsters.

One critical issue raised by the present results concerns the basis - given that it appears not to have been knowledge of the type-identity of the parts combined - upon which the preschool subjects responded differentially to the compatible and the incompatible monsters respectively. One possibility which would seem to be quite viable is that the children's judgements were based on some understanding which they possessed of the sort of parts which may and which may not co-occur in 'real world' animals. In other words, the children's responses may have been based, at least in part, upon knowledge of the relevant taxonomy at levels of abstraction higher than that of type. The appropriateness of this explanation is most clear in the case of the acceptance of the compatible monsters as non-anomalous. For these monsters it is apparent that relatively high level knowledge does have the potential to override the knowledge of the type-identity of the parts which subjects may possess and to lead thereby to failure to spot the anomalies. This would then appear to be an instance were gestalt effects are operative in the identification of representational materials. For example, in

(29) It should be stressed in this regard that since the adults were, like the children, warned about the possibility of anomalies, it would seem to be unreasonable to assume that these discordances were merely tolerated.

the case of the horse-cow monster, subjects might note the highly definitive head part, notice also that the body part is basically consistent with what they know that a horse's body should look like, and then identify the drawing as one of a horse.[(30)]

Consider next the case of the widespread rejection of the incompatible monsters. It is evident that the identification of these stimuli as monstrous is not necessarily dependent upon a knowledge of the particular types of both or one of the parts combined; specifically, a certain amount of superordinate level knowledge of the relevant taxonomies is sufficient to determine that these monsters are anomalous. For example, a subject would require only to know, in order to identify the horse-monkey as a monster, that animals with hands must also necessarily possess a (primate) face. It should however be emphasised that in the case of those preschool subjects who correctly identified the type of both the pertinent parts and even in the case of those subjects who correctly identified just one of these parts, the recognition that the incompatible monsters were anomalous was (as suggested by the justifications which these subjects gave) probably not generally based exclusively upon superordinate knowledge but rather based, at least partly, upon type-level knowledge. (Several preschool subjects for example, identified the horse-monkey as monstrous on the basis that the bodies of horses do not have 'claws'.) The argument that subjects did use their superordinate knowledge of animal taxonomies to reject the incompatible monsters therefore derives most support from the widespread rejection of the pig-monkey monster by preschool subjects who failed on the screening session to correctly identify the type of either of the component parts.

Something should next be said with regard to the significance of the superordinate knowledge which, it has been suggested, was used by the preschoolers participating in the present study. This knowledge would appear to involve some awareness of the abstract concept of possibility. Donaldson (1976) accords special significance

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(30) N.B. In the case of the pig-cow monster, the preschool subjects who considered that it was non-anomalous were by no means 'agreed' as to what it was; interestingly however, those adult subjects who failed to identify this stimulus as anomalous consistently identified it as being a cow.

to this concept. Specifically, she notes:

> "Among the abstract concepts the notion of possibility is of rather special importance. For consideration of possibilities and making decisions about whether two world states can possibly both occur - that is, whether they are compatible or incompatible with one another - are at the root of inferential thinking. And it is one of the distinguishing characteristics of the human intellect that it is a system capable of inference. We conceive of the world as a place where, given certain information, we can be sure of other things of which we have no immediate knowledge, things which we have not verified in any direct way (Donaldson, 1976 p. 278)."

Consider then the present finding that whereas the children who knew the type of neither the pig's head nor the cow's body generally failed to identify the pig-cow as anomalous, the children who knew the type of neither the pig's head nor the monkey's body nevertheless generally identified the pig-monkey as anomalous. This finding suggests that children as young as four-years or so can make certain deductions from the knowledge of animal types which they do possess about the kinds of animal which are ecologically permissible. It should be emphasised that these deductions may be more intuitive than deliberated; what is clear however is that the acceptability of the pig-cow relative to the pig-monkey so far as the children were concerned was consistent with the considered judgements made by adult subjects concerning the relative oddity of these two monsters. The present results do suggest that young children possess some knowledge of the visual appearance of animals at multiple levels of abstraction; this implies in turn that children have some understanding of the hierarchical nature of the pertinent classificatory structures. This is significant because it has previously been noted (cf., Section 1.3) that the evidence that children possess superordinate level knowledge is fairly limited.

The present suggestion that children possess some superordinate level knowledge concerning legitimate types of animal is in some ways consistent with the view of Rosch and her colleagues (cf., Section 1.3) that young children are responsive to real world correlational structure. It should be emphasised however that Rosch considers the correlational structure she describes to be focused at her 'basic' (or the present 'type') level of abstraction and also stresses (eg., 1977) that young children probably do not have well formulated superordinate level concepts; whereas by contrast, the present study would appear to indicate that young children possess some knowledge of correlational structure which is not limited to the basic level.

The final topic which should be given some consideration here is whether the present results have any implications with regard to the manner in which young children go about identifying objects and representations of objects. In particular, the strong suggestion in the present findings[(31)] that, of the compatible monsters, the horse-cow monster was the least often detected and the giraffe-camel the most often detected, is consistent with the hypothesis that children, when making identifications of animals do, although they attend all the parts, pay particular attention to the heads. Thus it may be that the horse-cow is not so often recognised as anomalous because subjects, having identified the very type-distinctive head, do not check up on the identity of the body part with very great care. Alternatively however, in the case of the giraffe-camel, the body part, atypically, has a very type distinctive feature (that is the humps) which is salient for young children; the head part nevertheless appears to receive a fairly detailed examination by some of the children and, because this head (as most other heads) is fairly type distinctive, the anomaly is thereby spotted. It is interesting to note, in relation to these considerations, that observers of children's spontaneous drawings of mammals (including people) have commented that children tend to begin by drawing the head part and then progress to drawing the body parts (eg., Goodnow, 1977; Sully, 1896).[(32)]

[(31)] N.B. This finding was not clear-cut because strictly speaking the statistical groups (cf., Section 5.2.2 (c)) do not permit such a comparison.

[(32)] Nevertheless, one puzzling feature of these two accounts is that they include reproductions of monster drawings. Apparently such drawings occur spontaneously in development. Sully comments explicitly on the appearance of these drawings (the bulk of those he reproduces combine human parts with those of other animals but he includes - as does Goodnow - non-human monstrous combinations) and attributes the appearance of these drawings to force of habit; thus in Sully's view, the production of such drawings indicates that manual reproduction is far behind visual imagination.

It is evident that many structurally compatible mammalian monsters can be produced by combining a distinctive head with a body which is - in prototypical terms - broadly satisfactory but which is in fact actually type-discordant. The present findings clearly suggest that children (and also a large proportion of adults) would not spontaneously recognise such stimuli as being anomalous. It is worth reiterating that in the present studies both child and adult subjects were given a warning as to the possibility of the presented stimuli being monstrous; consequently, it would seem reasonable to suppose that, so far as everyday identifications are concerned - where stimuli are not expected to be anomalous - neither children nor adults will generally notice minor anomalies spontaneously.

In conclusion, the present study has demonstrated that the ability of preschool children to detect anomalies compares quite favourably with that of adults. It should be recognised that the current study presented several anomalies which were grosser than many of the anomalies presented by Vurpillot (1962). Nevertheless, the findings reported are not consistent with the view that young children necessarily identify objects (or representations of objects) on the basis, exclusively of single attributes; rather it is apparent that children take a co-ordinated view of the whole of a stimulus.[33] Concerning possible future studies, further investigation of children's knowledge of different kinds of the more incompatible anomalies may potentially be very revealing. In addition to following up, in more detail, children's knowledge of various structural incompatibilities there remain at least two further kinds of incompatibility which could be usefully investigated; these are firstly that based upon postural incompatibility (cf., Figure 19 p.168) and secondly that

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[33] It is noteworthy in this regard that several children actually had <u>insights</u> into the type-identity of particular parts when these parts were presented in the context of a discordant part. This is precisely the opposite finding to that which conventional wisdom might have anticipated since it is customarily held that young children will fail to spot an anomaly because their attention is centred on a particular part. By contrast however, the present findings suggest that children's ability to co-ordinate the elements in these stimuli is such that, in certain cases at least, children are enabled to identify parts by viewing them within the context of a discordant part.

based upon disproportionately sized parts (cf., Figure A; Appendix G).(34)

5.2.5 (b) Detection of ambiguities by preschool children

There were three main findings. Firstly, with regard to those figures received first, the children found it easier to spontaneously detect the ambiguity in the 'house-face' figure than the ambiguity in the 'duck and rabbit' figure. 36 per cent of the relevant children spotted the ambiguity in the house-face figure spontaneously. It should be noted however that contrary to expectations, the two component identities in each of the figures were found not to be equi-discriminable.

The second major finding concerned how subjects responded when, having failed to spot spontaneously the ambiguity in the figure first received, they were then shown a contextual aid complementary to the perceptual organisation of the figure which they had failed to perceive. Overwhelmingly, the response of such subjects - when they were familiar with the type of the identity portrayed by the contextual aid - was to reorganise their perception of the ambiguous figure and to identify each figure feature as being complementary to the contextual aid. Moreover, the great majority of these children were then able, when the unambiguous aid was re-covered, to reorganise their perception of the ambiguous figure at will (or else with only minimal assistance - cf., footnote no. 21a p.195).

The third and final set of findings relate to whether there was any evidence that the children were more likely to spontaneously spot the ambiguity in the figure received second than in the figure received first. Unexpectedly, although subjects were, for each figure, more likely to spot the ambiguity when the figure was received second than when it was received first, this effect was only significant (in statistical terms) when the potential practice transfer was from the 'duck and rabbit' figure to the 'house-face' figure. Specifically, 58 per cent of the children who received the 'house-face' figure second, spotted the ambiguity spontaneously.

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(34) It should be noted in regard to this figure that the adult subjects in the study reported in this Appendix, unanimously rated the proportionately sized monster (that of a sheep-pig) as less bizarre than a disproportionately sized monster (that of a sheep-elephant).

It follows from these results that a fairly large proportion of preschool age children will spontaneously spot ambiguities if they are given suitable figures and that an even larger proportion of such children will spot ambiguities spontaneously if appropriate practice has been gained. These then are the main constraints upon performance which have been identified in the present study. It should be stressed however, that it remains unclear at present what precisely makes an ambiguous figure a 'suitable' figure for presenting to children. In this regard it may be of some significance that whereas the ambiguity in the 'duck and rabbit' figure involves a left-right reversal, the 'house-face' figure ambiguity is a straightforward 'frontal' reversal. Thus, it may be that specific left-right reversal practice is required before large proportions of young children will be able to spot left-right ambiguities spontaneously. The use of colour in the 'house-face' figure may also have been a facilitative feature. More generally, the information which was given to the children concerning the 'magical' nature of the figures may also have been instrumental in facilitating performance. Additionally, as Elkind and his colleagues have shown, (cf., Section 5.2.1 (b)), the more each of the component identities is articulated, the more apparent is the ambiguity. It would seem therefore to be likely that an investigation of the factors which assist children to spot ambiguities spontaneously will elicit even greater proportions of successful spontaneous reversals than that obtained in the present study. In particular perhaps, it would be interesting to conduct some (relatively elaborate) training studies based on the present practice techniques and showing subjects a whole series of figures rather than just a pair of figures.

One particular limitation of the current study is that the two interpretations of the figures used were not equally salient, which seems to have made the children less likely to see the ambiguities.[35] Despite this limitation however, it is apparent that the present results do confirm that preschool children have a propensity for spotting ambiguities in representational figures that has not been

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[25] N.B. It was particularly surprising that the 'duck and rabbit' figure was not found to be equi-ambiguous since Fisher (1968) reports of the precise figure used that it is equi-ambiguous. Presumably however, Fisher's report is based exclusively upon adult data.

detected in previous studies. Particularly significant is that 58 per cent of the children who received the house-face figure second, spotted the ambiguity spontaneously. This percentage - obtained from a group of children with a mean age of 4:3 years[36] - is considerably in excess of the negligible-to-zero proportion of spontaneous reversals gained by Elkind and Scott (1962) with children of comparable age. The present results suggest that conclusions of the kind made by Vurpillot (1976 a) from Elkind's studies with composite figures - namely that,

> "It is this double role of a single unit that children appear to be incapable of appreciating before the age of about 7 years (p.147)"

- are premature.

It remains finally, to comment on the present finding that the exposure of the unambiguous contextual aids did lead so often to subjects reversing their perception of the adjacent ambiguous figure. It was noted above (cf., Section 5.2.1 (b)) that the response of subjects to these contextual aids would constitute an interesting question in its own right. In the event, the results obtained clearly support the conclusions reached above in relation to the findings gained with the monster stimuli (cf., Section 5.2.5 (a)) that young children can attend and co-ordinate disparate parts of a picture when making an identification. In particular, the present results confirm that children prefer to organise drawings <u>wholistically</u> rather than as disparate parts. Thus, whilst, in the case of the compatible monsters the children (and often the adults) made wholistic identifications as a consequence of assimilating a fairly type-neutral part to a strongly type-defining part, in the case of the ambiguous figures with an unambiguous (and initially conflicting) part adjacent, the children made wholistic identifications by changing their perceptual organisation of the ambiguous part. The preference which subjects evidenced for organising drawings wholistically surely confirms that preschool children possess considerable abilities with regard to the co-ordination of perceptual cues and indicates, once again, that children's identifications are based upon an integrated view of the component parts rather than (as tends to be assumed by Vurpillot and her associates) upon single parts only.

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[36] N.B. The mean age of those of these children who spontaneously spotted the ambiguity in the 'house-face' figure was 4:5 years.

CHAPTER SIX: SUMMARY AND CONCLUSIONS

> "A three-year old child sees a painted landscape with a boat in it, and says: "It's summer now!" even though it is really a winter scene that is represented. The boat is an individual moment in the childlike experience, and immediately determines the meaning of the entire picture." Heinz Werner, 1948 (p. 238).

At the heart of classical Piagetian theory is the idea that the perceptions and thoughts of young children are characterised by a profound inflexibility. Operational inflexibility is attributed in particular to preschool children's lack of the mental operation of reversibility and is said to result in a tendency to centre upon single, salient sources of information rather than a tendency to co-ordinate information from a variety of sources. This lack of co-ordinative ability is said to result in poor performance on both logical problems and perceptual problems involving quantitative comparisons. Recently, (Elkind, 1975; Vurpillot, 1976 a), Piaget's notion of centring has been invoked - though rather more explicitly be Elkind than by Vurpillot - to explain the poor performance of young children on a variety of tasks involving the identification or comparison of representational materials. As indicated previously (cf., Section 1.2) it is not entirely clear that Piaget would have explained young children's poor performance with representational materials in terms of the notion of centring; nevertheless, it is clear from Werner's comments (quoted under the chapter heading above) that such an explanation of this performance is, in many ways, a traditional kind of approach.[1]

In Chapter One it was argued (cf., Section 1.2) that many of the studies which have been taken to support this traditional view are characterised by quite severe limitations and that consequently, young children may in fact be better able to co-ordinate perceptual cues than has previously been supposed. The first level therefore at which the present series of studies attain significance concerns whether the resultant findings provide any support for the propos-

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[1] Indeed, it should be noted in this respect that Werner's comments are based upon an observation by Lombrosso.

ition that young children's co-ordinative skills in relation to representational materials have, in the past, been underestimated. And, as has been observed repeatedly in the experimental chapters, the present results do not appear - in general terms - to be very consistent with the conclusions reached by Elkind and Vurpillot. In addition, however, the present studies yield a considerable amount of information about how young children recognise and categorise representational materials in a variety of circumstances. In the next four sections the most important of all the present findings will be reviewed and discussed. These findings are grouped in terms of the four subject areas outlined in Section 1.1.

6.1 Preschool children's judgements of correspondence between objects and pictures

The judgements which will be considered in this section are those which were made in circumstances where children were indicating what they considered to be satisfactory pictures (or the most satisfactory pictures) of objects. This section is not therefore concerned with the results obtained when model objects were presented in type-same sets (see Section 1.4.4 for a discussion of this distinction).

The first finding was that when, for specific object models, a straightforward choice was given between a shape-only discordant, a colour-only discordant and an absolute concordant, preschool children typically preferred the absolute concordant. This preference was maintained whether the model object was physically presented or whether it was verbally described (cf., Section 2.2). This finding is significant because it indicates that young children are capable of co-ordinating more than one dimension of correspondence at a time. This finding also acquires significance, though, in relation to a second set of findings. Specifically, although preschoolers preferred the absolute correspondents they did not necessarily require these correspondents; rather they were willing, in certain circumstances, to accept pictures that failed to match the model with regard either to shape or to colour or even that failed to match the model with regard to both shape and colour. Most importantly however, this tolerance of erroneous pictures (tolerance that is, because, generally speaking the children were seemingly aware of the discordances which they permitted) was found to be highly systematised. Thus, the children almost always rejected those pictures which portrayed a different type of object to the type of the model. Additionally, however, whilst when objects were physically presented, preschoolers did not generally reject pictures which were discordant with regard to a type-modifying value, they did often reject such modifier-discordants when the model objects were not physically presented but were instead described.[2] Significantly, these results (which were obtained by Studies One and Two; cf., especially Section 2.3.3), were each found to occur independently of shape or colour correspondence per se. The results therefore disconfirm the widespread view (cf., Section 1.3) that young children tend always to pay more attention to shape correspondence than to colour correspondence. Nevertheless, although children do not necessarily pay more attention to shape correspondence than to colour correspondence it would seem to be almost undeniable that because shape changes will result, far more often than colour changes, in pictures becoming ambiguous or misleading as to type, there will be an effective attentional bias towards shapes relative to colours. The present argument is however that the generally greater attention paid to shape does not arise from any intrinsic attraction which children have for shape correspondence relative to colour correspondence.

These findings would seem to constitute strong evidence of young children's ability to co-ordinate their perception of shape and colour correspondences. It is unclear however to what extent children's correspondence judgements were based upon deliberated strategies. Thus, in the first place it is evident that generally speaking, young children do, at least for the relatively gross bases of correspondence manipulated, exercise a preference for a correspondence relation which is based upon logical identity. This is significant in view of the emphasis placed by Vurpillot upon young children's inability (as she supposes) to consistently judge logical identity accurately (cf., Section 1.2). It is possible however, that those subjects who in the pertinent study exhibited a preference for correspondence relationships based upon logical identity based their judgements more upon a process of straight-

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[2] This effect did not however persist at a significant level when modifiers accompanied the physical presentation of the objects.

forward perceptual matching than upon a conscious appreciation of the necessity for identity in representational pictures of objects. The results of the present correspondence requirements tasks may (by comparison with the results of the correspondence preference tasks) be rather more indicative of deliberated strategies. Specifically, these findings showed that although children do evidence a certain willingness to centre on single dimensions of correspondence, the patterns of 'centring' displayed are flexible and tend to be ordered systematically according to the type-concordance of the picture and, to some extent also, according to the modifiers which are given. Because of the flexibility in the dimensions which are 'centred upon' and because also, the correspondences which the children required were often less than those which, in comparable circumstances they preferred, the children's performance on correspondence requirement tasks does tend to suggest that many of them were - at some level or other - following a chosen rather than an involuntary mode of operating. In particular it would seem to be likely that in the case of the type-based correspondence requirements which were made when objects were physically presented, the children were systematically following some kind of cognitive rule; even so however, it is not certain that children were following such a rule consciously.

Consider next the results obtained when children were offered a restricted choice between a shape-only discordant and a colour-only discordant - for specific object models. It was found that preschool children tend to opt for the picture corresponding with regard to the type-defining value rather than the picture corresponding with regard to the type-modifying value. This effect was most pronounced when objects were merely physically presented but in the case of shape-type object models, it also persisted both when additionally, the models were described at the level of the noun phrase and when they were so described in the absence of the objects. In the case of colour-type object models however, the children did not generally opt for the type-defining value concordants when modifiers were given (cf., Section 4.3.3 for details). These findings confirm the conclusion reached in relation to the results of the correspondence requirements tasks that young children do indeed attach great importance to the type names by which objects are commonly called; but they also illustrate the responsiveness of young children to the giving of relevant modifiers.

The last set of results to be summarised in the present section largely concerns preschool children's performance when they were required to identify anomalous figure-line drawings with no specific referents as anomalous. The children generally detected the most bizarre (type) anomalies (as would be expected on the basis of the previously obtained results) but they did not detect the least bizarre anomalies (cf., Section 5.2.4 (a) i). Very interestingly, however, significant numbers of adults also failed to detect the least bizarre anomalies. (cf., Section 5.2.4 (a) ii). These findings are of particular importance because the great majority of the drawings and pictures which children identify in the course of their everyday experiences have no specific referents and may therefore only be recognised to be incongruous at the type level of abstraction and on the basis of internalised type knowledge.(3) Specifically, these findings seem to suggest that children do not pay very close attention to certain less distinctive features of the depicted objects (as for example, in the case of the body of a horse). This finding does in some way accord with the position of Vurpillot that children tend to focus their attention on certain salient features of objects. Very significant therefore is the finding that adults often focus their attention in a similar way. Taken together, these findings indicate (not surprisingly perhaps) that children and often adults interpret pictures <u>wholistically</u>; that is, they come to pictures expecting, reasonably enough, to make positive identifications and in making such identifications they often fail to notice minor type discordances. Most importantly however, the finding that the most bizarre monsters are rejected suggests (cf., Section 5.2.4 (a) i) that in actuality, neither the identifications of adults nor children were based upon consideration of just one part alone. Thus, even when the identifications were based primarily upon one of the parts, subjects' attention was not centred exclusively upon this part. In considering the relevance of these findings for children's everyday identification of pictures it should be noted that because

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(3) Clearly however there are exceptions, for instance, family photographs (eg., of people, pets and possessions) which typically have specific referents with which children are familiar.

the subjects in the present study were warned as to the possibility of the occurrence of anomalies it may well be that more subjects would fail to notice the more bizarre anomalies if no warning were to be given. How children and adults respectively would perform on such a task poses an interesting question for further research. Evidently, however, it is the case that drawings with a type-defining feature and reasonably compatible parts are not given the scrutiny which subjects' knowledge of the identity of the component parts would permit.

Consider now some more general implications of the findings reviewed in this section. To begin with, it is noteworthy that children consistently accepted pictures which were anomalous as to type so long as these pictures remained unambiguous as to type. This is evident both from the results of Study Seven (which showed that children fail to notice the most minor type discordances; for example, a bull's body was almost universally assimilated to a horse's head) and from the results of Studies One and Two (where many children would seem to have been aware that they were accepting type-discordants; for example, a blue giraffe). It was noted in Section 2.3.3 that the correspondence requirements made by the children participating in Studies One and Two were eminently reasonable in informational terms since they permitted all the objects to be satisfactorily distinguished. The results obtained by Study Six cast some doubt however upon the likelihood that the subjects participating in Studies One and Two accepted non-misleading type-discordants <u>solely</u> because they were informationally sufficient for the task in hand. Specifically, Study Six found that children's correspondence preferences for objects occurring in type-same sets did not generally reflect systematically the task requirement of differentially coding the objects when no modifiers were given (cf., Section 6.3 for a discussion of this finding).(4) It therefore appears to be quite likely that the widespread acceptances of non-misleading type discordants (such as blue giraffes) arises, at least in part, because such 'pictures' are in someway regarded as satisfactory (though albeit not the most desirable) pictorial represent-

(4) N.B. The finding that the giving of modifiers influences subjects' correspondence requirements (cf., Section 2.2.3) also suggests that children's correspondence requirements were not solely a function of the informational requirement to differentiate the objects.

ations. Young children may not therefore have strong expectations that pictures of objects should correspond very closely - in visual-perceptual terms - to the objects which they portray. Donaldson (personal communication, 1983) has suggested that young children may actually have only a vague idea of the distinction between pictures and written symbols and that this lack of differentiation may lead them to suppose that symbolic-like representations of objects (such as that of a blue giraffe or, for a blue round candle, a purple tapered candle) constitute valid pictures of those objects. One interesting line of evidence which Donaldson cites (Donaldson, In Press), concerns reports that young children may be uncertain whether adults read the words or the pictures when a story is being read to them. As Donaldson observes, it is precisely this kind of evidence which led Reid (1966) to the conclusion that young children actually have to learn the difference between pictures and written symbols. Donaldson also cites some recent work by Ferreiro (1978) who has come to a similar conclusion [(5)] on the basis of findings indicating that many young children pass through a 'stage' in which they expect that the only components of a spoken utterance which are represented in a transcription of that utterance are the (concrete) nouns. Interestingly, Clay (1979) has devised a 'Concepts about Print Test' in which she has incorporated a test item relating to whether children are aware that the message of a story is carried by the print and not by the pictures. Significantly, Clay (op.cit.) reports standardised data indicating that the proportion of 'average European children' succeeding on this item does not exceed fifty per cent until five years of age.[(6)]

The present suggestion is then that young children generally construe the essential relation between objects and pictures of those objects more in symbolic[(7)] than in figurative terms.

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(5) Ferreiro considers (cf., Ferreiro, 1978) that four-year olds do make some distinction between drawings and writing but, she suggests, the dividing line between these two modes of graphic representation is, for such children, rather nebulous.

(6) N.B. The test question is as follows: "I'll read you this story. You help me. Show me where to start reading. Where do I begin to read?" Children who indicate the print are scored as correct whilst children who indicate the picture are scored as incorrect.

(7) That is, in quite arbitrary terms.

Interestingly, Sully reached this conclusion many years ago. Thus, in commenting on children's drawings he observes:

> "The child is content with a schematic treatment which involves an appreciable and even considerable departure from truthful representation....the little artist is still much more of a symbolist than a naturalist (Sully, 1896 p. 383, 390)."

It is indeed well known that young children will accept very sketchy outlines as drawings of all manner of things; thus, for example, children may variously identify two irregular shapes and a few scribbled lines as a car or as a train and so on. The identification of such drawings tends of course to be very idiosyncratic. In the present studies however, young children's judgements of object-picture correspondence gave evidence of a considerable uniformity of opinion with regard to the acceptability of certain, quite symbolic correspondence relationships.

The preceding considerations suggest then that young children may possess a significant facility for learning to use quite arbitrary written symbols. It does seem likely though that as, with the course of development, the propensity of the young child for what may, in the very broadest terms, be called symbolisation becomes channelled into the acquisition of public written symbols, so there will be a corresponding decline in the general willingness with which the more individualistic pictorial representations of objects are accepted as pictures. (Until, that is, the much later development, if it occurs, of a readiness to accept abstract art forms.) Nevertheless, it seems likely that some willingness to use publically unambiguous symbolic drawings as pictures of objects persists throughout childhood. In this regard it would seem to be evident from the results reported by Barrett and Light (1976 - cf., Section 2.1) that the drawings of specific objects made by children in early-to-middle childhood are often much more publically symbolic in character than those produced by younger children. Deregowski (1977), citing Barrett and Light's study, raises the possibility (cf., also Cameron, 1938) that the use of such symbolic drawings may persist even in the case of sophisticated adults.

Although the present results do suggest that young children may not necessarily expect pictures to correspond very closely to their referents it would seem to be likely that children will only be inclined to accept the more symbolic relationships between objects and pictures in certain circumstances. Thus, to take the most blatant kind of case, it seems highly unlikely for example, that preschool children of European ancestry would be generally willing to accept a drawing of a South East Asian man or woman as a picture of their mother or father respectively. Support for this prediction may be derived from the proposal by Piaget (1968 a) that children develop an early appreciation of qualitative identity relationships which is based upon the dissociation of invariant from variant properties. It may be of course that such individual identity relationships are in a league of their own so far as children's object-picture correspondence requirements are concerned; however, it is possible that besides failing to tolerate symbolic object-picture relationships at the level of individual identity for personally known and distinguishable referents, children will also not tolerate the occurrence of symbolic object-picture relationships in other circumstances. One such possibility is that children's correspondence requirements (and preferences) may vary systematically according to the function which the picture is to serve. Thus, whereas children may consider for instance, that free drawings or pictures serving a coding function or pictures in cartoons may each be symbolic in character, the same children may not be so inclined to accept symbolic 'pictures' as, for example, illustrations in a nature book. It might also be interesting to examine at what age children become more intolerant of discordances between picture and referent when pictures occur in photographic rather than more informal graphic representational media.

Something should be said concerning the degree to which children's correspondence requirements were found, in the present studies, to be influenced by the giving of relevant modifiers. In particular, the finding that children were generally very responsive to modifiers when these modifiers were not accompanied by a physical presentation of the object referents has some implications for the kind of correspondence relations which young children like best between the text (which is read to them) and the pictorial illustrations in their picture books. The present results suggest that children desire such correspondences to be as close as possible and that whilst they will generally tolerate type-discordances so long as the portrayed identity remains unambiguous as to type, they will not be so willing to tolerate dimensional values which are in conflict with a relevant modifier which is given.

It has previously been observed (cf., Section 2.3.3) that the results of the correspondence requirements tasks are consistent with Luria's (1961) description of the development of verbal controls on behaviour. This account of Luria has been modified by Flavell (1977) who has suggested that the substantial growth of self-control which occurs in early childhood should not be attributed exclusively (or perhaps even primarily) to the influence of verbal factors. It is significant however that Flavell does consider that the ability to reflect on the meaning of language is a crucial contributor to children's success at school (cf., also, Beveridge and Dunn, 1980; Donaldson, 1978). The present evidence that the correspondence requirements of even very young children may be influenced by the giving of mere modifiers is of some relevance to these considerations because it suggests that many preschool children do already possess the ability to pay considerable attention to what is said to them. (See McGarrigle, Grieve and Hughes, 1978 for further evidence of young children's sensitivity to modifiers.) It should be emphasised though that the subjects in the present studies were not generally found to be responsive to modifiers when these modifiers accompanied the physical presentation of the model objects.

One new line of investigation which might warrant future investigation is the examination of the kinds of effect (if any) that superordinate level object category labels (such as 'animal standing up' or just 'animal') have on children's judgements of correspondence between objects and pictures of a different type but with a shared superordinate. Suppose for example that children were presented with a toy horse standing up but that the picture was of a toy cow standing up. Now such a relationship between an object and a picture of that object is not normally permissible (cf., Section 1.4.2) and indeed the findings of the present studies do suggest that children would not normally be willing to tolerate such a type-misleading discordance. The possibility has been considered above however that young children may not have a fully developed understanding of the kind of relationship which should exist between an object and a picture of that object (as intimated perhaps by their ready acceptance of a blue giraffe for example). Consequently, given that children do show some responsiveness to linguistic cues it may be that if the superordinate label 'animal standing up' or even just the label 'animal' was given, children would be more inclined to accept such a superordinate object-picture correspondence.

6.2 Preschool children's concepts of objects

The findings discussed in the previous section are consistent with the view that the first categories acquired by young children are type based. Particularly consonant is the finding that children's chief spontaneous concern in judging object-picture correspondence is, apparently, that pictures of objects should be unambiguous as to the type of the referent object. Clearly, if it is assumed that children's judgements about the adequacy of pictorial representations of objects in such circumstances can tell us about what children cognise to be the critical visual features of the referent objects then this finding strikingly confirms the view expressed in Chapter One (cf., Section 1.3) that the child's world is generically organised. Such a proposal is not new (cf., Section 1.3). The distinctive feature of the present proposal however, is that it is explicitly recognised that colour as well as shape may code generically definitive information and moreover that where this is so, young children will often attend to colour.

It should be cautioned that any deductions which are made from children's judgements of correspondence between objects and pictures concerning children's concepts of objects must to some extent remain open to question since clearly, more than conceptual processes are involved in judging object-picture correspondences. Accordingly, two sets of findings were obtained in the present studies which were intended to constitute a more direct assessment of children's concepts of objects. The first of these findings was that the spontaneous categorisations of representational material made by both children and adults were found to be type based (cf., Sections 3.2 and 3.3 respectively) rather than shape or colour based per se; since it is widely reported that young children do not easily make groupings at higher levels of abstraction (cf., Section 1.3), this finding provides some confirmation of the present proposition that the first categories established by children are type-based. The second finding also supports such a conclusion; specifically, when given model objects and offered a choice between a perceptual object correspondent and a functional object correspondent, preschool children reliably opted for the correspondent which preserved intact, the type of the model, independently of perceptual or functional correspondence per se (cf., Study Five: Section 4.2). Besides providing a powerful illustration of the varying importance of the various perceptual and functional bases which comprise different concepts, these two findings demonstrate then that young children are sensitive to such variations. Taken together, these findings strongly suggest that theories of conceptual development should allow for the rapid development of attention to language, which - it would seem - structures such sensitivity (cf., Section 1.3). It is important to point out that these findings should not be supposed to indicate that, in everyday life, identifications of different objects are necessarily based upon just colour or just shape or whatever; for, as Rosch and her colleagues have pointed out, there is often a considerable amount of correlation between these factors. What these results do draw attention to however are the limitations of those accounts of the conceptual processes of young children which pay insufficient attention to the diversity of the various perceptual and functional bases which evidently, may underlie these processes.

Three specific conclusions emerge. Firstly, the present results highlight the shortcomings of Rosch's suggestion (eg., Rosch, 1977) that shape and functional cues are invariably correlated at the generic level of abstraction. Secondly, the present results suggest, contrary to popular opinion (as expressed for example, by Rosch, 1977; Clark, 1974; Nelson, 1974 and Vernon, 1971) that young children do pay considerable attention to colour correspondence when making categorisations (and particularly so when making categorisations involving natural rather than artificial objects.) Thirdly and finally, these findings have some relevance for the ongoing debate between E. Clark and K. Nelson as to whether perceptual or functional factors are primary in conceptual development. Specifically, to the extent that these two theorists stress that either perceptual or functional cues are the essence (or the most fundamental aspect) of people's concepts of objects, the present results provide a qualifying emphasis upon the considerable variance which exists between different concepts as to the relative prominence of these factors in psychological terms.

It is apparent that the type groupings which were obtained in the present studies occurred at the generic (or type) level of abstraction and were underlain by nominal correspondences at this level. In the present view these nominal correspondences were of substantial significance in stimulating the groupings obtained. These features of the present results are significant because traditionally it is denied that such categorisations possess the status of genuine conceptual behaviour. The first reason for this is that the classical grouping experiments with representational materials (eg., Bruner and Olver, 1963) have required groupings to be at a level of abstraction which is one step higher than that at which generic groupings may occur. In addition however, Inhelder and Piaget (1964) have described the regrouping of objects as a function of the names by which these objects are called in terms of 'pre-concepts', reserving the terms of 'class of equivalence' and 'concept' for the so-called logical classifications (see Section 1.3 for a discussion of logical classifications). Piaget's position would seem to be (Piaget, 1951) that until the child reaches the stage of concrete operations, the same words are used in reference to a wide variety of meanings varying greatly with context and that consequently, groupings made by young children which are nominally based are unstable. In Piaget's view, stable internal representations do not develop until the child's concepts become hierarchically organised (cf., Section 1.3). It was noted in Chapter One, however, that everyday observation would seem to suggest that young children do use many common nouns reliably for a wide variety of referents in each of the appropriate categories. Such observations do provide considerable grounds for supposing that the type based groupings which occurred in the present studies would in fact be stable over the course of time. In the present view therefore there is no basis for rejecting type-based groupings as being non-conceptual on the grounds that they are likely to be unstable. There would not seem to be any good reasons either for assuming these groupings to be non-conceptual merely because they do not occur at a 'superordinate' level of abstraction.[8] As Rosch (1977) has commented in relation to some generic groupings which she and some of her colleagues obtained with young children, such findings indicate that what has appeared, in the past, to be a critical difference in the structure of the thought of adults and young children is in fact partly due to an artifact (that is the requirement for superordinate level groupings) of the content of the tasks customarily presented. Similarly, the present results also imply that, at the generic level of abstraction, there is little in the way of qualitative differences between the categorisations made by adults and the categorisations made by children. It is interesting to note, in considering these findings, that Fodor, in criticising Vygotsky's assumptions as to what it is to think logically, has commented that,

> "the young child differs from the adult not in the kinds of conceptual integrations it can effect but rather, in the areas in which it can effect them (Fodor, 1972 p.93; emphases in original)."[9]

It was noted in Section 1.3 that there is indeed a strong case for reviewing the classical doctrines with regard to the nature of genuine conceptual behaviour. This case is concisely summed up by Arnheim (1969) who has observed that,

> "unsuitably narrow notions of what constitutes abstract behaviour (also) derive from a devotion to the so-called categorial attitude - the ability to perform logical classifications (p.199)."

Thus rather than defining conceptual thinking strictly as the abstraction of a set of defining features and the relation between them, conceptualisation should perhaps be envisaged more generally in terms such as,

> "the process of constructing complex representations of the world (including oneself) and using these representations for the purpose of directing behaviour (Donaldson, 1976, p.277)."

The attraction of the latter kind of definition is that it allows for rather more flexibility in the kind of performance which is regarded as deriving from genuine conceptualisations. In the

[8] Though there is some evidence which tends to suggest that pre-school children do have some categorial knowledge at levels of abstraction higher than that of type (cf., Section 1.3 and, in relation to the present Study Seven, Section 5.2.5 (a)).

[9] It is also noteworthy, in relation to this issue of the alleged superiority of superordinate level categorisations, that Fodor (1976) has rejected the classical assumption that conceptual structures are necessarily hierarchically organised.

present view such flexibility is required because it is emphasised that everyday objects are perceived and acted upon in a variety of different contexts and that the same objects are likely to be differently conceptualised in different contexts (for example, depending upon whether or not verbal cues are given). Such a definition of conceptualisation also permits the various kinds of generic categorisation to be classed as genuinely conceptual.

In relation to Study Five (cf., Section 4.2) it is possible to argue that the box task, based as it is on the specific function of coding box contents differentially, is not the kind of neutral context which is traditionally used when evaluating individuals' concepts. In this way it might be argued, the box task procedure may have predisposed subjects to prefer the linguistic (type) correspondents rather more than would have been the case with a traditional 'context'. It may indeed be that the degree of linguistic correspondence preference may vary according to the function to which the object (or picture) is put (cf., Section 6.1); however, if this is so, it is not at all clear that sorting tasks carried out in neutral contexts necessarily constitute the most valid test of pre-school children's natural conceptual groupings. Moreover it may be contended in this regard that since there would appear to be few, if any, real-life situations where objects are not serving some function or other - even if this function is purely aesthetic - it would surely be unreasonable to study conceptual thinking independently of contextual influences. It should be stressed in this regard that functional cues have roles in everyday contexts which they can rarely fulfill in artificial contexts. It is noteworthy that recently there has been some movement away from the old approach of studying children's conceptual thinking in artificial contexts (see, for example, Nelson and Gruendel, 1981). One more naturalistic study of children's conceptual thinking which arises from the present findings would be to carry out a correspondence requirements study with objects (exclusively) in which children would be sent to the 'shops' to obtain specified items. The children could be provided with information about the purpose for which the object was to be used and their choice of options when they arrived at the shops could be systematically controlled. Such a study would surely tap the classes of equivalence which children (and adults) have to use in everyday life.

One factor which is stressed in the classical accounts of concept development which has not been discussed so far is that subjects should be conscious of the grouping principles underlying the categorisations made. The question is then whether the child and adult subjects who made the type-groupings which have been reviewed in this section were conscious that the grouping principle underlying their categorisations was that of generic type. It was noted in Section 1.3 that, traditionally, the criterial indicator that subjects are conscious of the grouping principles is the demonstration that subjects can regroup stimuli by a second grouping criterion. Such regroupings are however notoriously difficult to obtain with young children (cf., Section 1.3). Significantly. however, the third and final finding to be reviewed in the present section is precisely that a majority of preschool children were found to evidence the ability to make regroupings when the materials provided a sound reason for doing so (cf., Section 3.2).

Two such double groupings were widely made; in each case, one grouping was colour based whilst the other grouping was shape based. Whereas, however, in the first case, one of the two groupings was within-type(10) whilst the second grouping was between-types, in the second case, both of the groupings were type-based. It is important to emphasise however that each of these four groupings was based upon a real-life association. Thus, although the subjects made multiple groupings using distinct criteria - which indicates that these groupings were deliberated over - the groupings made were not arbitrary. The children were not able to group objects which were, for them, experientially unassociated. In assessing the children's inability to make more arbitrary groupings it is interesting to consider the observation of Fodor (1972) that it is difficult to see why young children should be expected (as traditionally they are on classification tasks) to deduce that they are required to make purely dimensionally based groupings. In this regard also there has

(10) N.B. With regard to the widely made between-type pairing of the blue fork and the blue spoon it is possible that the shared colour of these items may have had little to do with the frequency with which they were paired. Whether or not the colour correspondence was significant in this respect poses an interesting research question.

been some discussion in the relevant literatures as to the possibility that the logical implications of terms such as 'same' may not be the same for children as for adults. It nevertheless remains, despite these observations, that young children do appear to be relatively poor (relative that is to older children and adults) at spontaneously making purely decontextualised groupings which are based on arbitrary grouping criteria.

Two main conclusions then have emerged so far. Firstly, young children appear to perform comparably to adults with regard to certain groupings based on real-life experiential associations (including associations which are based upon generic equivalence). Young children seem likely moreover to be conscious of some or all of the criteria upon which these groupings are based. Secondly, young children appear to be relatively poor at making more arbitrary groupings (and they are also probably poor at making groupings at levels of abstraction superordinate to the generic level). It should be emphasised that the suggestion that classificatory skills develop earlier with respect to some contents than others is not new (see, for example, Farnham - Diggory, 1976). Piaget too (cf., Brainerd, 1978) recognised the occurrence of such performance variance and invoked the concept of 'horizontal décalage' to explain performance differentials with respect to the same logical content in different situations. In purely logical terms there would not seem to be any distinction between groupings arising in relation to meaningful and less meaningful materials and consequently it seems likely that, in the Piagetian view, the notion of décalage would be invoked to explain the present finding that the ability to regroup material with multiple experiential associations occurs in advance of the ability to regroup material with only a single experiential association. What is striking about the present results however, is that evidence of regrouping was obtained from children as young as 3:1 years. Since implicit in the notion of horizontal décalage is an acknowledgement that such performance differentials should be accounted for in terms of a quantitative rather than a qualitative lack of the necessary cognitive structures, the Piagetian interpretation of the present results would appear to be that children as young as three years possess cognitive structures sufficient for some logical classifications. It is evident however that young children may have considerable difficulties with logical classifications which are not based upon real-life associations - even when adequate reasons are provided for such groupings (cf., the results of Study Six; Section 4.3.3). Consequently, the present results are perhaps most reasonably regarded as having tapped not a single ability but rather two separate kinds of ability. It should be emphasised however that the classificatory skill which young children do display would seem to amount to much more than mere automated and perceptually based responding.

It has been suggested above that young children form representations of objects based upon their everyday experience which should be regarded as being genuinely conceptual. It has been further suggested that many of these representations will be type based. It is perhaps reasonable to envisage therefore that when 'presented with' objects in the real world, children (and adults) are fairly widely predisposed to encode type-defining values more prominently than cues at other levels of abstraction. There are however, several qualifications which should be made in respect of the present emphasis upon the widespread attention to object types by young children, older children and adults. The first of these qualifications concerns the bases which may function as type-defining values. In the present studies, the only type-defining values which have been investigated have been shape, colour and to a lesser extent, functional cues. It is evident however that many other kinds of perceptual value may function for a smaller or a greater number of individuals as type-defining values for certain types of object; these include texture, movement and size as well as values in each of the non-visual perceptual modes. Very little work appears to have been done though on young children's ability to recognise the non-visual cues. In particular perhaps, the auditory mode would seem to provide type-defining values for a great many types of object (eg., different types of machine and animal). Children's ability to identify auditory cues is of special relevance to their conceptual understanding of what they hear on television; indeed an interesting question in this regard concerns how young children perform when they are asked to detect auditory-visual discordances for different types of object.[11]

A second qualification pertaining to the present proposition that children and adults widely adopt a generic based approach to objects in the real world arises from some observations made in an influential paper by R. Brown (1958 a). Brown (op.cit.) - upon whose ideas Rosch based her formulations concerning the 'basic' level of abstraction[12] - proposed that things have particular names which tend to be the names most often used to refer to them; these names Brown observes, are at 'the usual level of utility in the adult world' and tend to be the names first acquired by children.[13] Brown identifies two factors however which may cause the name given to an object to be something other than the utility name. The first of these factors concerns special interests, and knowledge which may be possessed about the object (for example, certain individuals who have a particular interest in cars may spontaneously name a red Lotus eclat as 'an eclat' rather than as 'a car'). The second factor pertains to those cases where a special relationship exists between the object and the person naming the object (each of us will, for example, have a group of people and animals with whom we are on 'first name' terms). In consideration of Brown's very reasonable remarks it seems clear that individuals (children as well as adults) will always spontaneously categorise some everyday objects at levels of abstraction other than that of type; which objects are so categorised will, however, vary greatly between different people.

Olson (1970) has extended the preceding line of thinking and has suggested (as has been noted elsewhere) that different names for the same referent may be used by the <u>same</u> people to draw attention to different aspects of the (same) concept. This variance is not necessarily constrained however by factors so overt as the immediate

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(11) N.B. A case study carried out by the writer with a single four-year old child found that a variety of identity conflicts between still photographs and sounds obtained from a B.B.C. sound effects record, were detected with considerable facility.

(12) Rosch was Brown's doctoral student.

(13) N.B. Brown does point out however that children and adults may not commonly categorise some kinds of object at the same level of abstraction (the example that Brown gives is that whereas American adults speak of 'dimes' and 'nickels', young children will speak rather of 'money').

context in which an object appears; one of the examples Olson gives is the implicit difference implied by the descriptions: 'King of England' and 'Owner of Buckingham Palace'. It follows from Olson's observations that names for particular objects should not be regarded as static labels which an individual will always produce; different names may be used to provide particular information about a referent to which the speaker wishes to draw attention. Olson's remarks amount to a third qualification of the proposition that objects will generally be spontaneously categorised at the type level of abstraction; specifically, the circumstances of the categorisation may influence the identification processes. There are other kinds of circumstance, though, which may cause some or all of the type-defining values of an object to be omitted from the initial stages of everyday categorial processes or alternatively to be omitted from the processes of identification altogether. Many such situations arise when objects must be identified on the basis merely of parts of the object because the rest of the object is obscured, absent or not operable. Consider for example, the case of identifying objects at sea. Certain objects may be initially identified as just an object of a particular colour but may then become clearly identifiable as a boat (rather than as, say, a buoy or beacon); other objects viewed only at a considerable distance may only be identified however as an object of a certain colour (or even as just 'something').

It remains finally in this section to comment upon the poor appreciation shown by a surprisingly large proportion of preschool children of the type discordance of certain type-discordant pictures. Children were particularly ill-informed about type-legitimate colours but were generally rather more knowledgeable concerning type-legitimate shapes.(14) It should be noted that children probably possess more type knowledge than the results of the present type knowledge tests initially suggest; thus, for example, whereas a large proportion of the children participating in Study Three said that blue

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(14) One reason for this may be that the shapes of objects much more often than the colours will be constrained by functional considerations (cf., Section 3.3.4). Additionally, however, children may be more exposed to colour-type discordances than to shape-type discordances in everyday life (see the following discussion).

giraffes do occur in the real world, few of these children made a spontaneous grouping involving the blue giraffe; rather they preferred to pair the two type-concordant pictures (cf., Section 3.2.3). Nevertheless, however, the fact remains that large numbers of children failed to correctly identify many of the type-discordant stimuli as anomalous. In considering the development of type knowledge it is apparent that the modern Western child has to contend with many unnaturally coloured objects (eg., punk hair styles, yellow poodles and the like) as well as many unnaturally coloured and shaped representations of objects in the various visual media (eg., pink elephants and stylised rabbits). Clearly, the high incidence of such type discordances in the young child's world can serve only to impede the development of accurate type knowledge. It is of course, possible to control children's access to the media (eg., books and television) in such a way as to reduce their exposure to type-discordant stimuli. It should be noted however that the consequences, from the child's point of view, of being exposed to a wide variety of type-discordances may not all be dire. In this regard, Bettelheim (1976) has speculated that the existence in the child's world of some ambiguity as to what is real and what is not may stimulate the development of imagination and creativity.

6.3 Preschool children's ability to use more symbolic forms of external representation

It has been noted in the last section that young children do show some ability to make cross-type groupings involving items which are associated in their everyday lives. The results of interest in the present section concern preschool children's ability to make cross-type groupings which are not intrinsically meaningful but which are meaningful in informational terms given the circumstances of the groupings. In the relevant study (that is Study Six; cf., Section 4.3), preschool children were given the task of using pictures to code objects differentially. Four critical objects were each presented in a type-same and a type-different object set. The type-same sets constituted the experimental conditions. Specifically, for each object the children were given a straightforward choice between a picture discordant with regard to a type-defining value and a picture discordant with regard to a type-modifying value. The nature of the picture options was so arranged that for the objects occurring in the type-same sets, the children were obliged - if they were to code the objects differentially - to make cross-type pairings (for example, to use a picture of a red jug to code a red toothbrush). In this way the children were provided with a sound external reason for making cross-type pairings (that is, a reason not based on a real-life association between the items grouped). The results obtained indicate (cf., Section 4.3), when the picture choices for the same model objects occurring in type-different and type-same object sets is compared, that significant numbers of children shifted their correspondence preferences according to the composition of the object sets in such a way that they were more likely to make cross-type pairings in the case of the type-same sets. There is however, an important qualification which should be made with regard to these results. Specifically, this shift in correspondence preferences only occurred reliably (that is for each of the four critical models) when the models were both described and physically presented. (There was strictly limited evidence of this effect when objects were merely physically presented and only slightly more evidence of this effect when objects were merely described at the level of the noun phrase.) Nevertheless, there was fairly strong indication in the justifications given by the children for their picture choices that many of those children who did choose the type-discordant pictures for the models in the type-same sets, did so in a deliberate fashion, being consciously aware of the informational consequences of their choices. Taken together, these results therefore suggest that preschool children possess quite a considerable ability to use symbolic kinds of external representation in meaningful ways.(15) These results also confirm that preschool children possess a fairly substantial ability to make multiple classifications of the

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(15) N.B. The pictures discordant with regard to a type-defining value whilst, in some way physically resembling their respective models were hardly proper figurative representations (ie., physically similar to the referent) and consequently their essential status seems more accurately described as symbolic rather than as figurative. Incidentally, to the extent that the present findings indicate that preschool children can consciously use pictures as symbols, they would seem to disconfirm the supposition (cf., Section 1.2) that young children fail to fully appreciate that pictures are merely representations of objects.

same material and, most importantly, they additionally indicate that preschoolers may, in certain circumstances, group items that are not associated in everyday life. Such findings are significant because traditionally, the ability to make the more arbitrary kinds of grouping has been regarded as a cornerstone of conceptual thinking (classically defined) and has been assumed therefore to be beyond the capabilities of the preschool child (cf., Sections 1.3 and 6.2).

One important question concerns the reason why the children participating in Study Six did not reliably code the objects occurring in type-same sets differentially unless the objects were both physically presented and verbally described. It bears repeating in relation to this finding that both Luria (1961) and Babska (1965) have reported that very young children are assisted to distinguish a single target box from other boxes by the introduction of names for the distinguishing feature of (or on) the box (cf., Section 2.1).(16) It would seem clear that the present results indicate that children's spontaneous thinking (that is, in the absence of modifiers) is so influenced by type considerations that they are generally very limited in their ability to make cross-type groupings spontaneously other than those based upon a real-life association (cf., Section 6.2). Nevertheless, children's ability to make non-experientially based cross-type groupings would seem to be greatly facilitated by the giving of modifiers. It is attractive to understand this finding as a case where, in Olson's terms (cf., Olson, 1970) the modifiers were used to reinforce to the children the significance placed by the experimenter upon these values; a significance moreover which children appeared to pick up quite readily. What is not so clear however, is whether the children for whom the objects were not

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(16) N.B. It appears that in both these studies there was <u>no</u> physical similarity between the object in the target box and the distinguishing feature of (or on) this box. Additionally, the subjects in both studies would seem always to have <u>seen</u> the target objects. It should be emphasised however that whereas these studies required subjects merely to <u>remember</u> the distinguishing feature, the present study required subjects to <u>choose</u> the pictures which would differentially code the box contents. The present task would therefore seem to be far more demanding cognitively. Interestingly, Babska (op.cit.) also reports that the kind of cover on the boxes - that is, as to whether they were geometric figures, colours or pictures of animals - was also a determinant of children's performance. Infuriatingly though, the precise effects obtained are not specified.

described (who did not generally make cross-type groupings) were aware of the informational consequences of their picture choices. Thus, it may be that these children failed to notice the need for objects in the type-same set to correspond to the type-modifying values; alternatively, however, it may be that these children did recognise this need but were limited in their ability to set aside type correspondence. What would be very interesting in this regard would be to examine preschool children's spontaneous correspondence requirements for objects occurring in type-same sets to see whether they generally require absolute correspondence for such objects (thereby evidencing recognition of the informational demands of the composition of the object set) or whether they merely require the correspondents to be unambiguous as to type. An alternative method of examining children's spontaneous sensitivity to the informational demands set up by type-same sets would be to employ the same restricted picture choice as Study Six to the extent that children would be required to choose between a shape-discordant and a colour-discordant but to omit the requirement for the children to have to choose a picture discordant with regard to a type-defining value; for example, children could be given a set of objects and picture choices along the lines of those illustrated in Figure 15 (cf., p.117).

The present evidence that language may have a facilitating effect upon children's ability to use pictures symbolically does provide some illuminating hints concerning possible methods which might be effectively used to train young children to use symbols. In the first place, the preschool subjects appeared to appreciate readily the task requirement of using distinguishing labels to code the location of objects. The present results suggest, moreover, that young children might be quite easily taught - via the use of externally given modifiers (which, in Luria's (1961) terms, may modify children's perceptions) - to use the nearly fully symbolic type-discordant representations used in Study Six to code hidden objects uniquely. It seems only a short step, once this point has been reached, to teach young children to use (for themselves) completely arbitrary symbols for the concrete referents in such a situation and ultimately to do so without the need for being given verbal cues. The possible benefits of such a preliminary programme for later training pertaining to the use of publically shared symbols may be considerable.[17] In a similar vein, Reid and Low (1972) have suggested that signs with a comprehensible context in public print actually serve as a way of attracting children into reading. The serious implementation of a training programme of the kind suggested would constitute, because of its rather indirect approach, a shift from traditional emphases in educational practice. The immediate everyday benefits from the acquisition of the ability to use public symbols would however make the implementation of such a programme worthwhile if it were to be shown to be more successful than established techniques.

6.4 Preschool children's ability to detect ambiguities

The final major subject area to which some of the present results have relevance is that of children's ability to detect ambiguities in representational figures. The most significant of the present findings was that after having previously received just one ambiguous figure (which in most cases also involved being given the opportunity of a brief training experience), a majority of preschool children subsequently receiving the 'House-Face' ambiguous figure were found to spot this ambiguity spontaneously without any further assistance. This finding is significant because it has been concluded by Elkind and his colleagues (and also Vurpillot) - cf., Section 5.2.2 (b) - that young children are basically unable to recognise such ambiguities. It should be emphasised however that although up to 58 per cent of the children spotted the ambiguity of the 'House-Face' figure, it must be presumed - on the basis of the data reported by Elkind (eg., Elkind, 1964) - that from 8:6 years or so, the very great majority of older children would, having been instructed to look for ambiguities, have spotted the ambiguities in both the figures presented.

There are reasons why the present result may not tap fully preschoolers' ability to spot ambiguities (cf., Sections 5.2.4 (b) and 5.2.5 (b) respectively). Nevertheless, even so, young children would still seem likely to have more difficulty with spotting ambiguities than older children. It may be however that the

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(17) Additionally, such a programme could of course be used to teach children the distinction between representational pictures and symbolic representations.

difficulty for young children lies not so much in a basic inability to spot ambiguities per se as in the particular difficulty of detecting pre-specified ambiguities. It is noteworthy in this regard that young children will often give evidence of a spontaneous recognition of ambiguities informally - for example, they might comment of an odd shaped and slightly wrinkled tomato that, 'it looks like the face of a man'. Thus, the standard technique of presenting figures with pre-set ambiguities to identify may constitute a conservative measure of children's ability to detect ambiguities per se. One alternative method would be to present figures which are so little articulated that they permit the children to appreciate readily that they may not have made the identification intended by the drawer. One attraction of such a method (which would not specify acceptable identifications in advance) is that it would make use of children's known readiness (cf., Section 6.1) to identify the most minimal outlines as drawings of particular objects.

6.5 Methodological issues

At the outset of this thesis (cf., Sections 1.2 and 1.3) it was suggested that the traditional view that young children are severely limited in their ability to co-ordinate information may derive, to some extent, from the failure of traditional studies to employ the most appropriate materials, procedures and results' assessment criteria. With regard to classificatory skills it was suggested that young children will employ a variety of categorisation criteria and that the particular criteria used may vary systematically according to the kind of material and the circumstances of the categorisation.

In accordance with these ideas the present studies investigated how children categorise different material in a variety of circumstances. Considerable care was taken to inform subjects concerning any special characteristics of the material presented and concerning the purpose of the categorisations requested. In this way the categorisations made by different children in different circumstances were explored for systematic variations.

At the beginning of this chapter (cf., p. 222) it was observed that the results gained by the studies reported in this thesis are not generally consistent with the view that young children are severely limited in their ability to co-ordinate information. However, two important methodological issues arise. The first of these concerns the limited scope of the present investigations; in particular, each of the present studies have examined children's performance with only small stimulus samples. The second issue concerns the extent to which the information given to subjects concerning the purpose of the categorisations requested (including, where necessary, the special characteristics of the material presented) was communicated satisfactorily.

Consider then the limits placed on the present research by the small stimulus samples. It has been stressed in the preceding paragraphs that the present research has sought to investigate how flexible children are in their categorisations in different circumstances and with different kinds of material. In the present view, insufficient attention has been paid in the past to the possibility that children's categorisations do vary according to such qualitative constraints. The present studies therefore tapped children's categorisations for a variety of objects in situations where they were required to identify (Study Seven), judge correspondence adequacy (Studies One and Two), make groupings (Study Three) and code objects differentially (Studies Five and Six). There is both a disadvantage and, at the same time, an advantage with such an approach. The disadvantage is that, because the number of content areas sampled was large, the present studies were restricted in the amount of follow-up work which could be done in any one area. In consequence, the number of stimuli sampled was often limited to those which could be included in a single study. However, the advantage of the present approach is that the sampling of performance over a wide spectrum of tasks provides a much broader base of information about children's categorisations in different situations than could otherwise have been obtained.

It should also be pointed out that considerable effort was taken in many of the studies to maximise the range of categorisations obtained. This applies in particular to the selection of materials used in the studies which examined children's (and adults') type-based categorisations (that is, Studies One-to-Five and, to some extent also, Study Six) and children's ability to detect anomalies

(Study Seven). In these studies the selected materials facilitated the examination of whether children respond in systematic ways to the qualitative differences that arise between different objects. Considerable evidence was gained-particularly with regard to the systematised use of type-defining values as classification criteria - that young children do indeed tend to respond systematically to these qualitative variations. It may well be of course that if some other kinds of materials had been used, then the amount of systematically structured responding would have been less. The discovery of the limits of this qualitative responding must remain however a matter for further research. It should be emphasised in this regard that the fact that these limits warrant investigation is something which has been established by the present research. It should be remembered that all too often in the past, children's categorisations have been studied or discussed independently of qualitative constraints altogether. This omission is widely found, for example, in the choice-preference literature - see, for example, pages 46, 47; in the debate concerning the relative prominence of perceptual and functional factors in children's categorisations - c f., page 117 ; and also arises in the case of Rosch's criteria for the internal representation of her 'basic level' objects - cf., pages 31, 32.

The second of the two methodological issues identified above as requiring discussion concerns the extent to which subjects were adequately informed with regard to the purpose of the categorisations requested. Four major questions arise. The first of these concerns two features of Study Five which, it might be argued, prejudiced subjects towards the choice of the functional correspondents relative to the perceptual ones. Specifically, subjects were asked to state 'what you do' with each of the model objects (p. 122). No comparable question was asked of subjects in relation to the perceptual features of the model objects. Moreover, in the case of two object models the stress on function was increased by lighting the candle and by writing with the lollipop-pen. The reason for stressing the functions of the model objects was that it was necessary to ensure that the object functions were fully understood and thereby to ensure that subjects were fully informed concerning the functional as well as the perceptual correspondence options which were offered for each model. It should be emphasised though that the bringing of subjects' attention to the functions of the object models was not as great a source of bias as might first appear. Specifically, the perceptual cues of each model - and also of each choice object - were operative throughout the experiment's duration in a way which the functional cues were not, as the objects were neither generally functionally operative nor acted upon according to their function. By contrast, the model objects were functionally operative for only a very limited period and the choice objects were at no point functionally operative. In the present view therefore, if there was any overall bias in the procedures used, it acted to prejudice subjects towards the choice of the perceptual correspondents.

A second question concerns the degree to which subjects participating in the object-picture correspondence studies appreciated that they were to select pictures that would code the model objects differentially. The critical study was Study Six (c f., Section 4.3) where the object sets and picture options were arranged so that differential coding could only be achieved if particular grouping criteria were used. In this study (as with all the correspondence studies), the children were fully informed of the coding requirement of the task but additionally, they were shown (cf., p. 144) all the object models and picture options in each stimulus set before they were asked to make any correspondence choices.

It has been previously indicated (cf., p. 155-159) that some subjects may possibly have chosen the appropriate pictures on Study Six as a response to perceptual cues rather than because of recognition of the coding requirements. In consequence the main evidence pertaining to the degree to which subjects were aware of the coding requirements probably derives from the spontaneous comments and solicited justifications which were made in relation to the picture choices. This evidence is not completely comprehensive but nevertheless it does indicate that many of the children who did shift their correspondence preferences appropriately (as well as a small minority of those who did not) were fully aware, not only of the coding requirements of the task but also, of the informational consequences of their own choices (cf., p. 155-159, 242). With regard to the remaining children it is noteworthy that those who failed to shift their correspondence preferences appropriately may well have done so because of an unwillingness to set aside their preferred choices rather than because of a failure to appreciate the informational demands of the task. This question remains unresolved however and further research is desirable to establish whether children generally make picture choices which code objects differentially in situations where they are not required to set aside their own preferences (see p. 244 for some proposals in this regard). It may well be though that the modifiers promoted appropriate shifts in correspondence preferences in Study Six because they reminded subjects of the coding requirements. If this is so, it may be that when the point comes to make the picture choices, children who receive purely physical object presentations will be less conscious than children who receive verbal object presentations of coding requirements.

The third and fourth questions, concerning the extent to which subjects appreciated task instructions, arise in relation to the anomaly and ambiguity detection tasks respectively in Study Seven. Consider first the effectiveness of the instructions to look for anomalies. Both the child subjects (cf., p. 192) and the adult subjects (cf., p.285) were informed that the anomalies would comprise head-body mis-matches. Furthermore, for each stimulus, both child and adult subjects were asked to say whether the head and body matched or failed to match. Subjects would seem therefore to have been fully informed concerning the nature of the anomalies to look for; moreover, the manner of framing the critical question asked in relation to each stimulus should have reinforced this awareness. Despite this emphasis however, it is apparent that considerable proportions of the children, and also of the adults, failed to detect the least bizarre anomalies. The question arises then as to whether these low detection rates are largely attributable to shortcomings in the instructional format used. In the present view this appears unlikely. Rather, the main explanation seems simply to be that both adult and child subjects found the least bizarre anomalies difficult to detect; the more bizarre anomalies were, after all, widely detected by both groups. It may be however that the detection rates would have been greater if subjects had been previously shown some relatively mild monstrous combinations as exemplars.

Consider finally the instructions used in relation to the presentation of the ambiguous figures. These instructions (cf., p.193) involved telling subjects - falsely - that the picture itself would change. In a few cases children responded after a while that the picture was not changing (cf., p. 194). There is therefore a possibility that the instructional format used discouraged subjects from seeking actively for alternative perceptual organisations of the stimuli (cf.. footnote no. 11 p. 176). This limitation could be avoided by changing the instruction simply to - 'this is a picture of two things at the same time - can you see what they are?'. Alternatively, the present instructional format could be retained but it could additionally be stressed at the beginning - 'that you have to look for the change - it doesn't just happen.'

6.6 Final remarks

As indicated by the preceding discussion of the present results in four separate sections (that is, Sections 6.1 - 6.4), the results of the present studies do not lend themselves to a corporate analysis. Despite this, there is a central theme: specifically, each of the studies have been in some way concerned with the ability of young children to co-ordinate diverse sources of information when categorising representational material. The sources of information varied have predominantly been perceptual cues; however the role of linguistic factors in children's categorisations has also been of central concern. It is these main issues which will be the basis of the discussion in this final section.

As has been observed repeatedly in the present chapter, the present results strongly suggest that young children are much more sophisticated in their categorisations than traditional investigators have supposed. In particular the results suggest that young children evidence a considerable degree of flexibility in their categorisations and that these categorisations are often tailored to suit individual situations. Young children's approach to categorisation then appears to be to a considerable degree constructive. However the present results do also expose several ways in which young children are limited in their ability to make categorisations.

In considering precisely what the present results reveal concerning young children's categorisations it is helpful to analyse the requirements made by the present tasks for perceptual and conceptual processing respectively. As it was noted in Section 1.2, the mere recognition of representational materials necessarily involves conceptual as well as perceptual processes; indeed the determination of the roles of these two processes is a recurrent question in work on figurative perception (cf., Elkind 1969). Vurpillot (1976a) though, taking the view that perception is a form of knowledge, contends that the search for a precise boundary between what is 'perceptual' and what is 'intellectual' is a 'pseudo-problem'. It would certainly seem that with regard to figurative perception at least, it is not possible to draw a distinct boundary between what is perceptual and what is conceptual. Nevertheless, it is perhaps helpful to imagine the present tasks as being on a continuum from (at one pole) the tasks which would appear to most involve perceptual processes relative to conceptual processes to (at the other pole) the tasks which seem to be more completely conceptual in character. The present tasks would seem to be clustered at three points on the continuum (cf., Figure 27); it would seem to be more certain however that each of these clusters is correctly ordinally scaled than that the order of tasks within each cluster is correctly scaled. Thus, closest to the perceptual pole is the correspondence preference task and the ambiguity detection task-for which the only role for the conceptual processes would seem to be to permit the recognition of the depicted identities (and even this role would not seem to be necessarily fulfilled for satisfactory performance on the correspondence preference task). The four tasks in the middle cluster of tasks would each appear to reveal something about the nature of the child's categorial systems concerning everyday objects; nevertheless, the more traditional grouping tasks (cf., task numbers 5 and 6 in Figure 27) would seem to provide the clearest measure of these systems because they give the child more categorial possibilities. Finally, at the 'conceptual' pole there are two further tasks: the differentiation of objects in type-same sets by the choice of type-discordant pictures and, the spontaneous making of second choice groupings which are not based upon real-life associations. These latter two tasks require the task materials to be treated much more arbitrarily than do the other tasks.

Figure 27 A tentative scaling of the present tasks according to their relative requirements for perceptual versus conceptual processing.

MOST PERCEPTUAL/LEAST CONCEPTUAL

1. Object-picture correspondence preference judgements (Study One).
2. Detection of ambiguities in ambiguous figures (Study Seven).

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3. Detection of anomalies (Study Seven).
4. Object-picture correspondence requirements judgements (Studies One and Two).
5. First-choice groupings of representational material (Studies Three, Four and Five).
6. Second-choice groupings based upon real-life associations (Study Three).

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7. Choice of type-discordant pictures to code objects in type-same sets differentially (Study Six).
8. Second-choice groupings on basis of purely arbitrary grouping criteria (Study Three).

MOST CONCEPTUAL/LEAST PERCEPTUAL

It is evident that whilst, with the possible exception of the ambiguous figure task, (18) the children mostly performed fairly well on the first six tasks (that is task numbers 1 - 6 in Figure 27), they did have difficulties with the two tasks which were most arbitrarily conceptual in character. Nevertheless the findings gained by the first six tasks would seem to provide considerable evidence of young children's ability to co-ordinate perceptual cues in categorisations. The range of co-ordinations tapped by these tasks is considerable - including, as they do, accurate judgements of absolute correspondence, recognition of ambiguities, detection of anomalies, systematised tolerance for object-picture discordances (systematised, that is, with regard to object types and verbal cues), first-choice groupings

(18)

N.B. Although the children participating in Study Seven did not actually perform very well on this task, there are reasons (see, for example, Section 6.4) for supposing that young children may be rather better at detecting ambiguities than the present results suggest.

based upon object types and second-choice groupings based upon experiential associations other than type. Together, these results confirm that young children evidence considerable flexibility with regard to the properties of objects which they use in their categorisations. In addition, in the present view, the tasks in the middle cluster in Figure 27 provide important information concerning how children's flexible approach to categorisation is systematised by their use of their conceptual knowledge of objects and by their sensitivity to verbal cues. This information will now be considered in some detail.

In Section 1.3 (p.20) a distinction was drawn between concepts - that is, all the knowledge a person possesses - and categories, which are usually formed on the basis of only some of a person's conceptual knowledge. It was pointed out that there is considerable disagreement in the pertinent literatures as to which of the possible perceptual and functional bases of similarity are those actually used in the formation of categories. The suggestion was made (eg., p. 24, 25) that a consideration of all the qualitative differences arising between different kinds of natural object strongly implies that the bases upon which particular categorisations are made will be greatly influenced by the kind of material being categorised. It was further suggested that linguistic cues lead to the emphasis of different kinds of information in children's internal conceptualisations of different objects and that these differences in encoding will be reflected in the categorisations which children make in relation to this conceptual knowledge. One particular scheme was developed to investigate whether these qualitative differences between objects are reflected in the criteria used by young children in their spontaneous categorisations. This scheme was that which distinguished different object types. Specifically it was proposed that, from the early preschool years, language is heavily involved in mediating the development of children's knowledge of the particular bases of the generic (or type) categories referenced by common nouns. Each of the first five of the present studies were directly concerned with investigating children's (or in one case, adults') tendencies to make type-based categorisations (cf., task numbers 4 and 5 in Figure 27); these studies merit particular attention at this point.

The basic proposal was that adults and children will generally respond spontaneously to objects at the generic (or type) level of abstraction - that is, the level of abstraction denoted by the noun most commonly used to refer to each object. A critical distinction made was between type-defining and type-modifying values. This distinction contrasts the range of dimensional values implicit in a type name with those which vary between different members of a given object type and are not implicit in the type name (cf., p.48). It was suggested that when making spontaneous groupings of, and judging correspondence between, representational materials, children's and adults' decisions will generally tend to be based upon type-defining rather than type-modifying values. Thus the categorial criteria used would be expected to vary between different objects according to those bases which are required to preserve object types.

The present results generally confirm this proposal; in particular, evidence was gained that children and adults will tend to group representational materials by types rather than by perceptual or functional cues per se or else unsystematically (cf., task number 5 in Figure 27). With regard to object-picture correspondence judgements however (cf., task number 4 in Figure 27), children's categorisations were not wholly regulated by whether or not all the type-defining values were preserved. Specifically, the present results indicate (contrary to expectations) that so long as the object type is conveyed unambiguously, young children will tolerate some type-discordances. It was also found that the overt articulation of particular type-modifying values tended to reduce subjects tolerance of discordances pertaining to these values. Thus, when judging correspondence adequacy, young children are not concerned solely with type correspondence. Nevertheless, these results still disconfirm the traditional view that, when making categorisations, young children centre their attention more or less arbitrarily upon salient cues. By contrast there is considerable co-ordination of linguistic, perceptual and also functional cues. The co-ordinations evidenced in first-choice groupings appear to be largely a direct function of children's conceptual knowledge of all the qualitative properties of the (linguistically defined) object type. The co-ordinations evidenced in correspondence judgements are a function both of children's wider conceptual appreciation of the correspondences necessary to convey type unambiguously and also, of how, if at all, the object is described. These results appear therefore to confirm that children respond in systematic ways to qualitative variations between different objects; they also confirm that the notion of object types and the distinction between type-defining and type-modifying values is a useful basis for analysing some of this responding.

It bears comment that the present evidence gained for the widespread use of type-based categorisations confirms that linguistic cues do play an important role in children's categorisations. Thus, for objects or pictures which are not named (or else given type names), children tend to prefer to categorise by the perceptual or functional values implicit in the type name rather than by other characteristics. Moreover, children's judgements of correspondence adequacy are influenced by externally given modifiers. It should be pointed out however that the potency of the modifier effects may be in some part due to the coding function which the pictures served in the present correspondence tasks; modifiers may have less effect on children's judgements of correspondence adequacy in other contexts.

Although the findings relating to type-based categorisations dominate the results gained by the first six tasks coded in Figure 27, one other finding warrants mention. Specifically, the anomaly study (cf., task number 3 in Figure 27) gained evidence which suggests that children also use superordinate level conceptual knowledge in their categorisations. The most pertinent finding was that the pig-monkey monster (but not the pig-cow monster) was generally identified as anomalous by children who could not correctly identify the type of the component parts (cf., p. 213-216). This finding lends further support to the present suggestion that children's approach to categorisation is a highly flexible one.

Consider next the two most conceptual tasks indicated in Figure 27 (p.253). These tasks - requiring as they do that the subject consciously make intrinsically arbitrary classifications - correspond most closely to the traditional kind of conceptual task (cf., Section 1.3). It is not therefore surprising that of all the tasks presented, children performed least well on these tasks. In the present view, the capacity for the more arbitrary forms of thinking required for satisfactory performance on these tasks is not necessary either for conceptualising or categorising (cf., Section 1.3). Clearly however, the development of these abilities is a fundamental aspect of cognitive development - one of the skills required for arbitrary thinking for example is the most important skill of self-regulation.

The present findings suggest that young children are not generally able to group representational materials by purely arbitrary grouping criteria. Significantly, however, one of the present studies (task number 7 in Figure 27) found that young children do sometimes make intrinsically arbitrary object-picture groupings when they are provided with a sound external reason for doing so (it was explained that the model objects had to be coded differentially). The factor which was critical in eliciting these intrinsically arbitrary groupings was a verbal one. Specifically, the articulation of pertinent modifiers substantially increased children's ability to treat the representational materials arbitrarily. When the model objects were both shown and described, 46 per cent of the preschool subjects changed their grouping criteria appropriately for two or more of the four critical object models. This finding suggests then that young children do possess some ability to make intrinsically arbitrary categorisations and is consistent with Luria's (1961) theory concerning the role of language in the development of self-regulatory mechanisms.

Consider at this point the full range of categorial skills displayed by young children in relation to the tasks coded in Figure 27. It is apparent that many young children do evidence considerable flexibility in their categorisations. However, there are several qualifications which should be made. Firstly, as has just been observed, children's generally constructive approach to categorisation is constrained by their limited abilities to carry out categorisations based upon arbitrary grouping criteria. Secondly, children evidenced some limitations in the categorial flexibility which they could employ when identifying anomalies and ambiguities. It should be emphasised that the present results are not generally consistent with the traditional assumption that, when identifying representational materials, young children tend to centre their attention involuntarily upon salient features of the materials. Instead the present evidence that many young children detect bizarre anomalies and simple ambiguities (and also, are generally influenced by contextual aids to shift their perceptual organisation of ambiguous figures) indicates that young children will generally pay attention to various of the properties of the stimuli when making their identifications. Nevertheless, there were limits to the categorial flexibility displayed; not all the children were successful and, with regard to the detection of anomalies, young children did appear to be marginally less adept than adults. There was also evidence that certain characteristics are ultimately more determinative of children's identifications than others. A third limit to children's flexibility in making categorisations follows on from this last point. Specifically, children would seem to be constrained by a tendency to make type-based categorisations rather than other kinds of categorisation. There are several reasons for thinking this. First, children (and also many adults) tended to identify relatively compatible anomalies in terms of the type of one of the component parts (task number 3 in Figure 27). Second, when judging the adequacy of pictures as correspondents of physically presented objects, children did not often require absolute correspondence but did typically require the pictures to convey type unambiguously (task number 4 in Figure 27). Third, children's spontaneous groupings (as with adults' groupings) were generally type-based (task number 5 in Figure 27). Fourth, children did not easily forgo type correspondence when this was required in order to code objects differentially or when they were simply asked to make arbitrary groupings (task numbers 7 and 8 respectively in Figure 27). Of these reasons, the second and fourth tend to suggest that young children are more predisposed to employ type-based categories in their categorisations than adults are. This is because adults would generally be expected to judge object-picture correspondence in absolute terms and also to make arbitrary groupings upon request or whenever the informational constraints of a task demand this. It appears then that whilst both adults and children possess much of the conceptual 'know-how' required to make many and various type-based categorisations, children are particularly likely to employ type-based categories in their categorisations. It would also seem that it is children who use the greater variety of type categories (consider, particularly, children's toleration of some type-discordances between objects and pictures). It does not appear then that children's type-based categorisations are based wholly upon static internal type-categories; rather these categories show some flexibility. Thus, although children are more predisposed to make type-based categorisations than adults, children do show some flexibility in the kind of type-categories employed.

In this thesis great stress has been placed upon children's tendencies to make categorisations which are based upon type-defining values. Typically, the present studies have contrasted children's tendency to make spontaneous groupings based upon type-defining values with their avoidance of groupings based upon type-modifying values. The present studies have however only sampled a few of the many possible type-based categorisations (cf., Section 6.5). One important question which therefore arises concerns the extent to which type-defining values can be accurately and reliably identified across the whole range of object types in the world; more fundamentally perhaps, the question arises as to whether the distinction made between type-defining and type-modifying values can always be maintained. In asking this question it is worthy of note that there is something of a parallel between the present distinction and Katz and Fodor's (1963) contrast between semantic-markers and semantic distinguishers.[19] Katz and Fodor failed to precisely specify the criteria to be used in distinguishing semantic-markers and semantic distinguishers and, in consequence, the whole basis for the contrast became a contentious issue (see, for example, Bierwisch 1969). So then it is important to ensure that the present distinction between type-defining and type-modifying values is clearly made.

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[19] This distinction was intended to contrast the part of the meaning of a lexeme which is systematic for the language with that which is not systematic. The systematic meaning components were represented by semantic-markers and the non-systematic components by semantic distinguishers. The markers permit the recognition of anomalous word combinations (eg., 'male' cannot be combined with 'pregnant') in a way which parallels the present idea that an appreciation of type-defining values permits the recognition of visual anomalies.

The use of the present terms was stated originally in Chapter Two (p.48) and has been re-stated in the present section (p. 3,4). Specifically, type-defining values are the range of dimensional values implicit in a type name whereas type-modifying values are the values which vary between different members of the same type but are not implicit in the type name. The materials used in the present studies were such that the pertinent type-defining and type-modifying values could be reliably specified. The question which arises however is whether this distinction can be generally maintained. Five factors warrant mention in this regard. First, the present studies tended to manipulate type-defining values which were simple and dominant - as for example, in the single shape-type value implicit in the type "ball". Many type-defining values are however more complex - compare, for example, the various shape-type values of the type "typewriter". Second, as previously noted (p.105), many dimensions other than shape and colour supply type-defining values. These other defining values derive, for example, from auditory, olfactory, tactual and functional cues. Third (also as noted previously, cf., p.240) the type-defining values for a given object may not be simultaneously operative (eg., a candle may not be lit, a car engine not switched on or a bicycle wheel missing); alternatively, they may still be operative but not all may be perceivable. Fourth, it is important to emphasise that the same dimension may provide both type-defining and type-modifying values. For example, the colouring of tigers is a type-defining value and the type hypothesis therefore predicts that correspondence will be preferred with regard to this value than with regard to a posture change merely (cf., p.47); clearly, however, certain shape changes (e.g., those required for a change from tiger to lion) would constitute an alteration of type-defining shape values. It is evident then that dimensions per se are not type-defining or type-modifying for an object; rather it is particular values which are. The fifth and final factor is that in certain cases, the status of a value - that is, as to whether it is type-defining or not - may vary according to context. One case is that of ball-size. Ball-size is, to a limited extent, a type-defining value; for example, certain objects could not reasonably be identified as a ball because either they are too large or they are too small. Consider though the case of the identification of a picture of a ball. If the picture contains an adequate indication of relative size (eg., a boy), ball-size is maintained as a type-defining value; if, however, no information is given concerning relative size, ball-size ceases to operate as a type-defining value.

It is evident, from a consideration of the five factors identified, that the specification of all the type-defining and type-modifying values which are usable for particular objects in specific contexts is not necessarily a simple business. Nevertheless, in the present view, many of these values can be accurately specified in most circumstances. Most importantly, once a value of a particular object in a particular context has been identified, it should then be possible to determine whether it is a type-defining or a type-modifying value. The critical rule to follow here is that if the value can be changed in unlimited ways and yet the type-identity of the object be maintained, it should be classified as a type-modifying value; to the degree however that such changes are not possible, the value is type-defining.

One pertinent question which arises from the present research concerns the extent to which the identification of type and type-modifying values provides a basis for accurately predicting the categorisations made by children (and/or adults) in particular circumstances. It has been previously noted (eg.,p.259) that the present research indicates that children will sometimes make categorisations which do not use all the type-defining values of the stimuli as categorial criteria. Such categorisations were however systematically regulated. Thus, when judging correspondence adequacy in a coding task, children simply required that pictures of physically presented objects should be unambiguous as to type. Because children's use of type-defining values does appear to vary systematically according to the circumstances of the categorisation the present work does imply that the distinction between type-defining and type-modifying values is useful as a tool for predicting categorial behaviour. Clearly however further work is required to discover more about the precise conditions in which particular type-based categorisations occur; such work should include study of the range of stimulus types to which each of the sets of type-based categorisations identified is applicable.

Another important issue concerns the extent to which type-based categorisations are influenced by first, specialised knowledge of the materials and second, lack of type knowledge.

A second area for further research which follows on from the issues just discussed and which, to some extent, overlaps them concerns the role of contextual factors in children's categorisations. The present studies found that children were quite sensitive in their categorisations to localised contextual cues on particular tasks; for example, the articulation of modifiers tended to reduce children's tolerance for discordances pertaining to the values marked, contextual aids facilitated children's recognition of ambiguities and so on. There is however considerable scope for varying the wider context of the tasks themselves; specifically, the present studies have exclusively been concerned with identification, decontextualised grouping and object coding tasks. The main emphasis has been on object coding. There are however many other contexts in which children's judgements of correspondence between objects and pictures can be investigated; moreover it seems likely that the context may have a critical influence upon the judgements made. It would be interesting and informative for example to compare children's correspondence judgements on object coding tasks with those made when pictures are being used for purely decorative purposes (eg., illustrating a greetings card). It may be that children's correspondence requirements for pictures serving a decorative function would be very lax indeed. Thus it may be that children would relax their requirements for unambiguous representation of object type in such circumstances; in addition, they might be far more inclined to tolerate discordances with regard to verbally marked type-modifying values. These issues particularly warrant empirical attention because of the present emphasis upon the constructive approach to categorisation displayed by young children. Thus, in the present view, if the contexts in which children's categorisations are tapped is strictly limited, then the categorisations that are observed will be unrepresentative.

A third set of issues for further research arises in relation to the present evidence (cf., task number 7 in Figure 27 - p. 253) that young children show some ability to make intrinsically arbitrary groupings when they are provided both with a sound reason for doing so and pertinent linguistic cues. Children's relative inability to make arbitrary groupings (relative, that is, to groupings with experiential associations) has been identified above as a major limitation of their generally constructive approach to categorisation. Significantly then, the coding format of the present study appears to provide a useful basis for an investigation of how children might be assisted to make intrinsically arbitrary and, ultimately, completely arbitrary groupings (cf., p.244). One specific question which could be researched in conjunction with such an investigation concerns whether, for physically presented object models, young children would select correspondents which adequately distinguish the models if they were not required to set aside type-correspondence in doing so. Such a study would clarify the extent of young children's <u>spontaneous</u> appreciation of the informational demands of such a task (cf., p. 155-159, 250). If young children were found to be sensitive to the informational demands set up by different model sets, this would - together with the present findings - confirm Ford and Olson's (1975) suggestion that whilst young children show some sensitivity to informational demands, they tend to prefer to discriminate objects from a context of alternatives which is wider than that necessary. That is, such a finding would show that, in the case of representational objects, young children have to code object type <u>as well as</u> the critical type-modifying values. Several suggestions regarding how such a study might be set up are given in Section 6.3 (p.244).

The general theory of cognitive development which is most consistent with the present results is perhaps that of Bruner (eg., Bruner, 1957; Bruner, Olver and Greenfield, 1966; Bruner. 1974). Bruner conceives of three forms of representation - the enactive, iconic and symbolic modes respectively - which develop additively. This sequence is in fact very Piagetian (cf., Section 1.3); most importantly however, whereas Bruner does recognise there to be a role for language in cognitive development (cf., also Butterworth, 1978), Piaget regarded this role of language to be strictly limited. Bruner also recognises there to be a role for perception in cognitive development; indeed he proposes (cf., also, Dewey, 1891 ; Werner, 1948 and Wohlwill, 1968) that there is a direct continuity in development between perceptual and conceptual processes. Such a continuity view is not necessarily required to account for the present results; however, it is an attractive mechanism, especially so in view of Bruner's emphasis (Bruner, 1957) on the generic base to all perception. The present results would perhaps tend to suggest though that the iconic mode of representation is rather more flexible than Bruner intimates; such a shift in stress is however in line with recent accounts of imagery which emphasise that images need not necessarily be static, illogical or even concrete but may develop into more dynamic and abstract forms (see, for example, Kaufmann, 1980; Kosslyn, 1978).

Appendix A: Details of the subconditions of Study One and of the comparisons made

A (i) Correspondence requirements tasks

Table A lists four picture sets, each comprising four pictures. Each child participating in Study One was presented with all the pictures in one of these sets; one picture (as appropriate) for each of the four critical objects. Altogether, twenty children (ten of whom were shown the objects and ten for whom the objects were described) were offered the pictures in each of the four picture sets.

Table A Critical picture sets presented.

Objects	Picture sets			
green ball	red ball	red ball	diamond 'ball'	diamond 'ball'
triangular sandwich	square sandwich	pink & blue 'sandwich'	pink & blue 'sandwich'	square sandwich
orange	triangular 'orange'	triangular 'orange'	purple 'orange'	purple 'orange'
blue, square button	round button	orange button	orange button	round button

Consider first the data yielded by the subjects for whom the objects were physically presented. Ten binary comparisons were made. These comparisons are listed in Table B below, together with a breakdown of some pertinent characteristics of the subject groups involved. It is evident that these comparisons comprise between-group comparisons and also comparisons involving both a between-group and a within-group component. As was noted in Chapter Two (p.70), in the latter kind of case (cf., in Table B below, comparison numbers 5, 6, 7, 8 and 10), Fisher's method was used to obtain an overall p-value for the between- and within-group components. A worked example of this procedure is given at the end of this appendix.

Consider next the comparisons made between the performance of subjects for whom the objects were physically presented and that of those subjects to whom the objects were described. Table C (below) lists these comparisons and gives a breakdown of the pertinent characteristics of the subject groups involved.

Table B Breakdown of the comparisons made; physical presentation condition.

Comparison No.	Nature of Comparison	total no. of Ss	mean age	age range	no.of boys
1.	between groups; red ball	20	4:1	2:10-5:1	10
	versus				
	diamond 'ball'	20	4:1	3:0-5:2	10
2.	between groups; pink & blue 'sandwich'	20	4:1	2:10-5:2	10
	versus				
	square sandwich	20	4:1	3:0-5:1	10
3.	between groups; triangular 'orange'	20	4:1	2:10-5:1	10
	versus				
	purple 'orange'	20	4:1	3:0-5:2	10
4.	between groups; round button	20	4:1	3:0-5:1	10
	versus				
	orange button	20	4:1	2:10-5:2	10
5.	between groups; diamond 'ball'	10	4:3	3:2-5:2	5
	versus				
	square sandwich	10	4:3	3:4-5:1	5
	within group; both stimuli	10	3:11	3:0-5:1	5
6.	between groups; diamond 'ball'	10	4:3	3:2-5:2	5
	versus				
	round button	10	4:3	3:4-5:1	5
	within group; both stimuli	10	3:11	3:0-5:1	5
7.	between groups; triangular 'orange'	10	3:11	2:10-5:1	5
	versus				
	square sandwich	10	3:11	3:0-5:1	5
	within group; both stimuli	10	4:3	3:4-5:1	5
8.	between groups; triangular 'orange'	10	3:11	2:10-5:1	5
	versus				
	round button	10	3:11	3:0-5:1	5
	within group; both stimuli	10	4:3	3:4-5:1	5
9.	between groups; purple 'orange'	20	4:1	3:0-5:2	10
	versus				
	red ball	20	4:1	2:10-5:1	10
10.	between groups; purple 'orange'	10	3:11	3:0-5:1	5
	versus				
	orange button	10	3:11	2:10-5:1	5
	within group; both stimuli	10	4:3	3:2-5:2	5

Table C Breakdown of the comparisons made between physical and verbal presentation conditions.

Nature of comparison	no. of Ss		mean age		age range		no. of boys	
	P.O.P.[1]	V.O.P.	P.O.P.	V.O.P.	P.O.P.	V.O.P.	P.O.P.	V.O.P.
between groups; red ball	20	20	4:1	4:1	2:10-5:1	2:11-5:2	10	10
between groups; square sandwich	20	20	4:1	4:1	3:0 -5:1	2:8 -5:3	10	10
between groups; round button	20	20	4:1	4:1	3:0 -5:1	2:8 -5:3	10	10
between groups; orange button	20	20	4:1	4:1	2:10-5:2	2:10-5:1	10	10
between groups; diamond 'ball'	20	20	4:1	4:1	3:0 -5:2	2:8 -5:3	10	10
between groups; pink & blue 'sandwich'	20	20	4:1	4:1	2:10-5:2	2:10-5:1	10	10
between groups; triangular 'orange'	20	20	4:1	4:1	2:10-5:1	2:11-5:2	10	10
between groups; purple 'orange'	20	20	4:1	4:1	3:0 -5:2	2:8 -5:3	10	10

(1) N.B. 'P.O.P.' (ie., physical object presentation); 'V.O.P.' (ie., verbal object presentation).

A(ii) Correspondence preference tasks

The comparisons made evaluated the degree to which the correspondences which the children preferred were more absolute than the correspondences which they required. Two comparisons were made in relation to each of the eight critical pictures listed in Table A; p. 265, that is, for each picture, one comparison was made for subjects for whom the objects were physically presented and one comparison was made for subjects to whom the objects were described. Thus, these comparisons were all within-group comparisons. The pertinent characteristics of the subject groups involved are evident from Table C.

A(iii) Worked example of Fisher's method

The example given below is for comparison number 8 in Table B above. The steps are as follows.

1. Obtain separate p-values for the between-group comparison and the within-subject comparison using appropriate tests. The p-values thus obtained in the present case are 0.3034054 and 0.032 respectively.[1]
2. Multiply the two p-values obtained at Step 1 (=0.0097089).
3. Find the natural logarithm of the figure obtained at Step 2. (ie., log e of 0.0097089 = -4.6347122).
4. Multiply the logarithm by -2 (=9.27).
5. Obtain final probability from table of critical values of χ^2. Where two probabilities only have been combined, look under d.f. = 4.[2] ($p \searrow 0.05$ just).

(1) The two tests used were Fisher's exact probability test and the sign test respectively. The probabilities given are two-tailed values.

(2) d.f. - that is, degrees of freedom. For n probabilities use χ^2 with 2ndf.

Appendix B: Verbatim accounts of procedures used in Study One[1]

(a) Correspondence requirements tasks

(a) i For physical object presentations

After the subjects had been introduced to the teddy and shown the cash-register the experimenter continued as follows: -

> "And where do you see tills like this?..... in shops, yes, you do don't you? Now do you know why the teddy has got one of these tills?..... Well, he's got a till because he wants to have a little shop. And teddy wants to sell some things in his shop.
> And these are the things that teddy wants to sell in his shop (E gives S the bag containing the objects). What's inside? What has the teddy got to sell in his shop ...?"

Once the objects had been named the experimenter placed the boxes on the table and continued:

> "Now what are these?.....boxes, that's right. Teddy wants to put these things inside (E gesticulates to the objects) so that there is one thing to sell inside each box. So here are the boxes. Would you help the teddy put them in?..... close the lids; that's right."

When each lid had been closed, the experimenter rapidly rearranged the position of the boxes and asked:

> "Suppose the teddy gets the boxes mixed up; do you think he would know what is inside the boxes? What's inside that one? (E points to a box). And that one? What's inside there do you think....?"

Once it had been demonstrated that the child could not remember the box contents reliably, the experimenter asked:

> "Well, if you don't remember what's inside the boxes I don't think teddy will be able to remember. Do you?.... No, so how do you think we can help teddy to remember what's inside the boxes....?"

Typically, the child did not answer and the experimenter then continued:

> "Well we could put something onto the boxes to help the teddy remember what's inside. In real shops, boxes have pictures to show what's inside - don't they?.... So we could put pictures on the boxes. Then teddy can look at the pictures and he will know what's inside the boxes. Now, over here teddy has got some pictures (E shows S

---

(1) N.B. The procedures reported in this appendix provide a much more complete account of the wording generally used by the experimenter. Inevitably, however, the precise wording used did sometimes depart slightly from that given.

the distractor picture sets). So teddy is going to choose pictures to stick on the boxes. And the pictures are going to show what's inside the boxes. So would you like to help him? Teddy will choose the picture and then would you stick it on the box for him? Thank you very much. Now sometimes teddy may choose a picture that doesn't show what's inside the box. So what are you going to do if teddy chooses the wrong picture....? Would you tell him then if he chooses the wrong picture? Because, then we can get him to choose the right picture can't we? Good.

So, shall we take this box first? (*E* gives *S* the box containing the toy Christmas tree). Right, so you tell teddy what's inside the box."

The subject then names the object and the experimenter then speaks to the teddy:

"__________(ie., the *Ss* name) wants a picture of the __________(ie., whatever the *S* named the object as). Which is the picture you want teddy? Is it this picture teddy?....no it's not that picture. Well is it this picture then teddy?....no you don't think it's that one either. Well is this the picture you want teddy?.... That *is* the picture you want is it?(2) Allright then, we'll show it to ______(ie., *Ss* name) and ask _______(*Ss* name) what (s)he thinks. (*E* then shows *S* the picture). What do you think ________(ie., *Ss* name)? Is this the right picture or the wrong picture?"

If a child rejected the picture chosen he or she was then asked: "Why is this the wrong picture then?" and the teddy was then asked to choose another picture:(3)

" - Well teddy, _______ (ie., *Ss* name) says that this picture (the teddy is 'shown' the picture) isn't the picture of the ________ (ie., whatever the *S* named the object as). Do you think you can choose the right picture this time? Which is it? Is this one the picture teddy? No that's not it. Well is this one the picture teddy? That one *is* the picture is it? Well let's show it to ______(ie., *Ss* name) and see what (s)he thinks."

---

(2) N.B. As indicated in Section 2.2.2 (d) i the precise number of pictures which the teddy refused was varied unsystematically though the number of refusals was constrained by the number of pictures under the flap.

(3) Unless that is (as occasionally happened) the basis of the child's rejection of the picture was spurious (eg., that there were 'black dots' on the purple orange). In these cases the error was pointed out and the critical question - that is, concerning whether the picture was the right picture or the wrong picture - was repeated.

The procedure was then continued as before.

When a picture had been stuck onto the lid of the first box, the S was then asked to choose the remaining boxes one at a time and the critical procedures were repeated in relation to each. Once a picture had been stuck onto the lid of each box the experimenter asked the subject to name the box contents:

> - "Well we stuck the pictures on so that we could remember what's inside didn't we? So we should be able to remember what's inside the boxes shouldn't we? So what's inside that one ?.... and that one ?.. (etc.)."

(a) ii For verbal object 'presentations'

The procedure followed for the subjects in this condition was as close as possible to that followed for the subjects in the physical object presentation condition. The only procedural differences arose from the fact that in the verbal presentation condition, instead of being asked to name the objects, subjects were always provided with the predesignated descriptions. Consequently the only major procedural difference concerns the manner in which the boxes were introduced. Thus, having explained that the teddy had a till because he wanted to have things to sell in his shop (that is, from the end of the first paragraph in the previous section), the experimenter then continued as follows.

> -"So the teddy has put the things that he wants to sell in these boxes (E puts the boxes on the table). There's one thing in each box. Listen, they all make different sounds (E rattles some of the boxes). You try (S then rattles the boxes). Now we can't open the boxes because look, they have sellotape over the lids. (E indicates the sellotape.) But look, there are words on the boxes (E points to some of the labels) and these words say what's inside the boxes. Let's see. Inside this box there's a ______ (ie.,predesignated description), inside this box there's a ______ (E names the contents of each box in turn). But teddy can't read the words and I don't think that you can read the words either? Can you read the words? (E quickly picks up a couple of the boxes and profers the labels for S to see) .... No you can't can you? So how is teddy going to know what is inside the boxes?..... Well, in real shops, boxes have pictures to show what's inside - don't they? And look, over here teddy has got some pictures (E shows S the distractor picture sets). So teddy is going to choose pictures to stick on the boxes. And the pictures will show what's inside the boxes. So,would you like to help

"teddy? I'll read the words and tell teddy what's inside. And then teddy will choose a picture and you can stick it on the box for him. Allright? Thank you very much. Now sometimes teddy may choose a picture that doesn't show what's inside the box ....."

(The procedure is then continued as for the subjects in the physical object presentation condition.)

(b) Correspondence preference tasks

(b) i For physical object presentations

Having placed on the table four boxes, each containing one of the critical objects, the experimenter began thus:

"Now then, can you remember what we were doing last time?..... Yes, the teddy (E indicates teddy) had a little shop didn't he? And the teddy wanted to sell some things in his shop. Then you put the teddy's things into these boxes (E gesticulates to the boxes) and teddy chose pictures to stick on. The pictures showed what was inside the boxes didn't they? If the picture was the wrong one you told teddy didn't you?.... but if it was the right picture you stuck it onto the box.

Well today we're going to do that again. But this time you are going to choose the pictures. So what's in the boxes? - you tell me."

When the subject had named the objects the experimenter (gesticulating to the objects) asked:

"O.K., so which one shall we do first?(S selects object). Right so now we'll put it back in the box and close the lid - that's it. Now here are the pictures. (E picks up the picture board and places it on the table.) So which picture do you want to choose to show what's inside the box?" (E opens the appropriate picture flap.)

The pertinent procedures were then repeated for each of the three remaining objects in turn.

(b) ii For verbal object 'presentations'

The procedure followed for subjects in this condition was similar to that used for the physical object presentation condition. Necessarily however, there were several differences. The full procedure followed is given below. The text is underlined where this procedure deviates from that followed for the physical condition.

Placing the four sealed boxes on the table, the experimenter began:

> "Now then, can you remember what we were doing last time?.... Yes, the teddy (E indicates teddy) had a little shop didn't he? And the teddy wanted to sell some things in his shop. And the things were inside these boxes weren't they? (E rattles some of the boxes). Lots of different things. And do you remember? The teddy chose pictures to stick on the boxes. The pictures showed what was inside the boxes didn't they? If the picture was the wrong one you told teddy didn't you? But if it was the right one you stuck it on the box.
>
> Well today we're going to do that again. But this time you are going to choose the pictures. First though, I'll read the words and tell you what's inside each box. Inside this box there's a ...... (E names each box in turn with the predesignated descriptions). O.K., so which box shall we do first (S selects box). That one. Allright. So, I'll read the words and tell you what's inside. Inside this box is...a____(ie., predesignated label). Now here are the pictures. (E picks up the picture board and places it on the table.) Which picture do you want to choose to show what's inside the box? (E opens the appropriate picture flap.)"

The pertinent procedures were then repeated for each of the three remaining objects in turn.

Appendix C: Details of the subconditions of Study Two

Table A (below) lists three picture sets each comprising five pictures. Each child participating in Study Two was presented with all the pictures in one of these sets, one picture for each of the five critical objects. Table B (below) indicates the numbers of

Table A: Picture sets presented.

Objects	Picture sets		
	1	2a	2b
yellow knife	yellow spoon	pink knife	pink knife
horse standing up	horse lying down	zebra	zebra
red teapot	green teapot	teapot-spoon	teapot-spoon
giraffe standing up	blue 'giraffe'	giraffe kneeling	giraffe kneeling
blue, round candle	purple, tapered candle	blue, tapered candle	purple, round candle

children in each of the three object presentation conditions who were presented with each of the three picture sets. It is evident from this table that twice as many children received picture set 1 as received picture sets 2a and 2b respectively. Table B also gives a breakdown of the nurseries attended and of the mean age, age range and sex composition of the children in each of the subject groups. It is apparent that these factors were balanced across these groups.

Table B Breakdown of some characteristics of the children in each subcondition.

Characteristics	Pres.cond.P[1]			Pres.cond.P-T			Pres.cond.P-T-M		
	picture sets			picture sets			picture sets		
	1	2a	2b	1	2a	2b	1	2a	2b
no. of children	20	10	10	20	10	10	20	10	10
no. from each nursery[2]	12;4;4	6;2;2	6;2;2	12;4;4	6;2;2	6;2;2	12;4;4	6;2;2	6;2;2
mean age	3:9	3:9	3:9	3:9	3:9	3:9	3:9	3:9	3:9
age range	3:1-4:6	3:3-4:6	3:1-4:7	3:1-4:7	3:0-4:7	3:3-4:6	3:2-4:7	3:2-4:7	3:2-4:7
no. of boys	10	6	5	10	5	5	10	5	5

(1) N.B. The presentation condition notation is as follows, 'P' (ie., Ss were merely shown the objects); 'P-T' (ie., Ss were shown the objects and given the type names); 'P-T-M̄' (ie., Ss were shown the objects and given the type name plus 1 or 2 relevant modifiers).

(2) The children who took part in this study were from three nurseries. The numbers of children from each nursery is indicated in the same position (ie., left, middle or right) in each column.

Appendix D Breakdown of names given by P condition Ss to the critical models in type-different and type-same sets respectively (Study Six).

Model stimuli	Names given: type-different sets			Names given: type-same sets		
	type	type plus modifier	other(1)	type	type plus modifier	other
yellow comb	23	-	1	20	4(2)	-
red toothbrush	23	1	-	19	5	-
round biscuit	23	-	1	18	4	2
horse 'sitting' down	19	3	2	17	7(3)	-

(1) N.B. This category comprises Ss who gave no response and, in two cases, Ss whose responses were not recorded by the E.

(2) N.B. One of these Ss omitted to mention the type name.

(3) N.B. In three cases, the modifier given related to the model's small size rather than its posture.

Appendix E Ss'picture choices (numbers) for the critical models in both type-different and type-same object sets as a function of the order in which these sets were presented (Study Six).

Model Objects	Object set order	Ss' picture choices (type-or modifier-concordants)[2] P t.m	m.m	m.t	t.t	P-T-M t.m	m.m	m.t	t.t	T-M t.m	m.m	m.t	t.t
yellow comb	T.D;T.S[1]	0	1	0	11	6	1	0	5	4	3	1	4
	T.S;T.D	3	1	2	6	1	7	0	4	5	2	0	5
red toothbrush	T.D;T.S	3	0	1	8	7	2	0	3	5	1	0	6
	T.S;T.D	1	0	1	10	5	1	1	5	3	3	1	5
round biscuit	T.D;T.S	8	2	1	1	5	5	0	2	2	10	0	0
	T.S;T.D	3	5	1	3	3	9	0	0	1	8	2	1
horse 'sitting down'	T.D;T.S	1	0	0	11	10	1	0	1	2	6	0	4
	T.S;T.D	3	0	1	8	1	11	0	0	0	12	0	0

(1) N.B. 'T.D' stands for type-different set and 'T.S' for type-same set.

(2) Choices for type-different sets are scored first, eg., 't.m'=type-concordants chosen for type-different set; modifier-concordant chosen for type-same set.

Appendix F Justifications (verbatim) given by Ss whose correspondence preferences shifted from the type-concordant to the type-discordant for type-different and type-same sets respectively. (Study Six.)

(i) Yellow comb model; P-T-M

S no.[1]	type-different set	type-same set
1	Because it's a comb.(1)[2]	'Cause it's yellow.(2)
2	It's a comb. (1)	Because it's yellow. (2)
3	'Cause there's a comb in.(1)	Because it's the same colour.(2)
4	'Cause it's a comb. (1)	Because it's the same colour.(2)
5	Because that's a comb and that's a comb in there. (1)	Because that's (ie., the picture) the same colour and that's the same colour.'Cause that's yellow and that's yellow. (2)
6	Because the thing, that is a brush, a comb in there.(1)	That's a yellow comb. (3)
7	'Cause there's a comb in it. (1)	Because there's a yellow comb inside. (3)

(1) These S numbers make it possible to compare the various justifications given by individual Ss whose correspondence preferences shifted for more than one model.

(2) These numbers indicate the category under which the justification was coded in Table 15 (p.152). Thus, 1 = valid type based; 2 = valid dimensionally based; 3 = indeterminate; 4 = none and, 5 = erroneous.

(ii) Yellow comb model; T-M

S no.	type-different set	type-same set
8	Because it's a comb. (1)	Because it's yellow. (2)
9	'Cause it's a comb. (1)	A yellow. (2)
10	Because there's a comb inside it. (1)	Because it's yellow. (2)
11	'Cause it's a comb. (1)	Because it's a yellow comb. (3)
12	'Cause that's a comb inside. (1)	'Cause there's a yellow comb inside that box. (3)
13	Hey! We've got mixed up - because that's a yellow and that's a red comb... because it's a red comb.(3)	Yellow. (2)
14	Because it's a yellow comb. (3)	'Cause that's (ie., the picture) a yellow comb. (5)
15	(4)	Because it's (ie., the picture) a yellow comb. (5)
16	Because it's red. (5)	This one's yellow. (2)

(iii) Red toothbrush model; P-T-M

S no.	type-different set	type-same set
1	That's the toothbrush. (1)	Because it's the same colour.(2)
2	Because it's a yellow toothbrush; because it's a toothbrush. (1)	The red one. (2)
17	'Cause it's the same, same toothbrush, but it's yellow. (1)	Because it's the same colour.(2)
18	Because there's a toothbrush. (1)	It's the same colour. (2)
19	'Cause it's toothbrush. (1)	Because it's red. (2)
20	'Cause there's a toothbrush. (1)	Because there's a red one in the box. (2)
21	This toothbrush-because it's the same thing. (1)	'Cause it's red. (2)
22	'Cause that's a toothbrush.(1)	'Cause that's red. (2)
23	'Cause it's a toothbrush.(1)	Because it's red. (2)
24	Toothbrush. (1)	(4)
25	Because it's a red toothbrush in there. (3)	Another red one. (2)
26	Because she'll remember that's the same inside but not the same colour. Because inside is red but on top is yellow. (3)	Because it's red on top and inside. (2)

(iv) Red toothbrush model; T-M

S no.	type-different set	type-same set
10	That's a toothbrush. (1)	'Cause that's red. (2)
27	It's a toothbrush. (1)	'Cause it's a red. (2)
28	'Cause it's a toothbrush.(1)	'Cause it's red. (2)
29	Toothbrush. (1)	Because dolly remember. (4)
13	'Cause it's the yellow toothbrush. (3)	That's the red. (2)
16	Yellow toothbrush. It's the right one. (3)	That one's red. (2)
30	'Cause dolly will remember. (4)	Because it's red. (2)
15	'Cause I want to show what is inside. (4)	Because I want to. (4)

(v) Round biscuit model; P

S no.	type-different set	type-same set
31	'cause it's a biscuit. (1)	Same shape 'cause it's a round circle. (2)
32	That 'cause the biscuit is in the box. (1)	Because there's a round biscuit in that one (ie., in the box). Because it's (ie., the picture) round. (2)
33	It's a biscuit. (1)	Because it's a circle one. (2)
34	Because it's a biscuit. (1)	Because it's (ie., the picture) a biscuit. (5)
35	Because it's a biscuit. (1)	'Cause it's a green biscuit (ie., the picture is); 'cause it's a biscuit. (5)
36	'Cause it's a biscuit. (1)	Because it's (ie.,the picture) a round biscuit. (5)
37	Because that's brown. (2)	Because it's, it's round. (2)
38	Because it's brown;because that biscuit is brown. (2)	(4)
39	(4)	Because it's the shape.(2)
40	(4)	Same shape. (2)
41	Show the dolly; see what's in it. (4)	Because it's (ie., the picture) a biscuit. (1)

(vi) Round biscuit model; P-T-M

S no.	type-different set	type-same set
21	'Cause it's the same thing; the same biscuit. (1)	'Cause that's round. (2)
20	'Cause there's a biscuit in it. (1)	Because it's a round biscuit in the box. (3)
5	Because that's, that's the same colour. (2)	Because that's a round one and that's round. (2)
7	'Cause it's brown. (2)	'Cause that's a round shape.(2)
42	Because it's brown.(2)	'Cause it's round. (2)
43	'Cause it's brown and it's the same colour. (2)	Because that's round. (2)
4	'Cause it's (ie., the picture) a square biscuit. (3)	Don't know. (4)
44	(4)	Because I want to. (4)

(vii) Horse 'sitting down' model; P-T-M

S no.	type-different set	type-same set
3	'Cause a horse in there.(1)	Because it's lying down.(2)
4	'Cause it's a horse. (1)	'Cause it's lying, sitting down. (2)
5	Because that is a horse inside and a horse here. (1)	Because it's sitting down and that's sitting down. (2)
22	'Cause that's a horse. (1)	'Cause it's sitting down. (2)
26	'Cause it's a horse in there.(1)	Because that one's sitting down and that one's sitting down. (2)
45	'Cause it's a horsie. (1)	'Cause it's sitting down. (2)
2	Because it's a horse. (1)	It's a horse running, a horse sitting. (3)
7	'Cause there's a horse inside. (1)	'Cause there's a brown horse sitting down. (3)
46	'Cause it's the same, same horsie. (1)	'Cause it's a stripy one.(5)
47	Because it's a horsie. (1)	'Cause it's (ie., picture) a horsie. (5)
23	Because it's the same colour.(2)	Because it's sitting down.(2)

Appendix G: A study of adults' identifications of animal parts, detection of monsters and judgements of the relative compatibility of different monsters

(i) Introduction

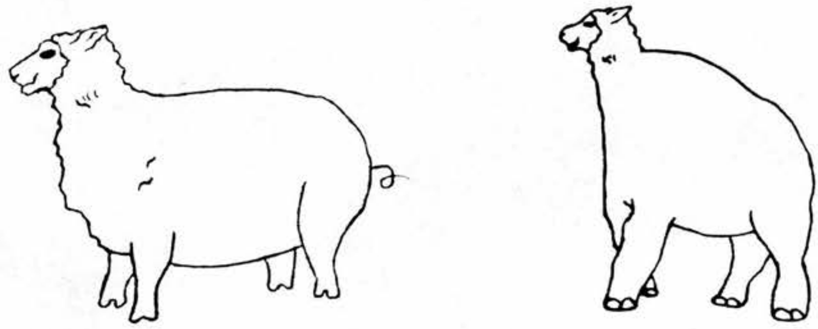
This study was conducted to gain information relating to three distinct questions which arise from the study of preschool children's ability to detect anomalies (cf., Section 5.2). The pertinent questions were as follows.

(1) To assess the accuracy with which adults identify the animal heads and the animal bodies which were presented to the preschoolers (cf., Figure 22 p.181). This information was required in order to determine firstly, how identifiable each of these parts in fact was and secondly, the relative ability of adults and preschool children to correctly identify these parts.

(11) To determine whether adults do, as tacitly supposed by the relevant literatures (cf., Section 5.2.1 (a)) correctly discriminate anomalous from non-anomalous stimuli. In particular, the study conducted with preschool children investigated (cf., Section 5.2.1 (a)) whether young children are more likely to detect as anomalous, monsters which were assumed to comprise highly incompatible combinations of parts than monsters which were assumed to comprise less incompatible parts. It was considered important to investigate whether any similar effects are evident with adults.

(111) To learn how adults rate the relative compatibility of the two members of each of the three monster pairs presented in the study with preschoolers (cf., Figure 24.C p. 188). This information was required so as to provide a concrete measure indicating, one way or the other, whether the assumption that the members of each of these monster pairs do differ qualitatively in terms of the relative compatibility of the parts combined was valid or invalid. In addition, it was also investigated how adults rate the relative compatibility of the members of two further monster pairs between which, it was hypothesised, the relative compatibility varies. The first of these pairs concerns a posturally based variation in compatibility and has been previously illustrated and discussed (cf., page 168) whilst the second pair concerns a variation in compatibility based upon whether or not the relative sizes of the parts combined are complementary. This second additional pair of stimuli is illustrated in Figure A below.

Figure A Two monsters comprising compatibly sized parts (that is, (i)) and incompatibly sized parts (that is, (ii)).



(i) (ii)

(ii) Method

The Ss were 18 first-year psychology students (7 men and 11 women), each attending Edinburgh University. Each of these Ss participated in two sessions, two weeks apart precisely. In the first session, Ss were presented with 25 incomplete drawings (in an unsystematic order) and asked to identify each drawing. These drawings comprised the 24 drawings illustrated in Figure 22 (p.181) plus one further drawing of the body only of a galloping horse (this body is that included in Figure 19 (b) p.168). Each S was given an instruction/response sheet, a copy of which is reproduced in Figure B below. The procedural details concerning this session are apparent from this figure.

Figure B Instruction/response sheet given to each subject in session one.

You will soon be given a pack of 25 drawings. Each drawing is numbered and what you are asked to do - if you will! is to write against each of the numbers below what you think the drawing with the corresponding number is a part of. These drawings have already been shown to some preschoolers and some adult data is required for comparative purposes.

It will be evident when you receive the drawings that they are not in order. This is intentional and you are asked please to work through the drawings from the top one down, in the order in which you receive them.

1________	6________	11________	16________	21________
2________	7________	12________	17________	22________
3________	8________	13________	18________	23________
4________	9________	14________	19________	24________
5________	10________	15________	20________	25________

Thanks for your help.

In the second session, Ss were presented with two further instruction/response sheets; that is, first the sheet featured in Figure C (i) and then the sheet featured in Figure C (ii) - see below. These sheets provide most of the relevant methodological details. Concerning the first of these sheets, however, (in which Ss were asked to discriminate monsters from non-anomalous animals) it should additionally be noted that the monsters presented were the six monsters presented to the preschoolers (cf., Figure 24.C) and that the non-anomalous drawings presented comprised the five drawings illustrated in Figure 24.B plus one further drawing of a non-anomalous rabbit. In relation to the second sheet presented in the second session (which asked Ss to judge the least bizarre member of each of the five pairs of monsters cited in the present introduction - cf., question three) it should be noted that the two members of each monster pair were mounted in a horizontal plane on a separate card and that the relative position of each pair member (that is, as to whether it was left or right) was counterbalanced between Ss. It should additionally be noted that these five monster pairs were presented in an invariable order; specifically the horse-cow and horse-monkey pair was always presented first and this monster pair was always followed by the giraffe-camel and the dog-camel, the sheep-pig and the sheep-elephant, the cow-horse (standing) and the cow-horse (galloping). and the pig-cow and the pig-monkey pairs respectively.

Figure C Instruction/response sheets given to each subject in session two.

(i) Sheet one:

You will soon be given some drawings. As before, each drawing is numbered and you are requested to write down against each of the numbers below what you think the drawing with the corresponding number is portraying. In some cases you may not think that the heads and the bodies match. So, for each drawing, what you are asked to do is to put a tick in either the 'O.K' box (if you think the head and body match) or the 'erroneous' box (if you think the head and body do not match). Then, in the remaining space, please indicate precisely what you think the drawing is of. So, if you have ticked the 'O.K' box you should say what the drawing is of or, if you have ticked the 'erroneous' box you should say what the head and body respectively are drawings of.

	O.K	Erroneous	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

(ii) Sheet two:

You no doubt decided that the heads and bodies in some of the drawings which you have just identified, failed to match. You are now asked to consider for some further drawings whether they vary in the extent to which the heads and bodies fail to match. Specifically, you are asked to consider 5 pairs of drawings and to indicate for each pair, which of the two drawings is, so far as you are concerned, the drawing which is the most acceptable (or, if you like, the least bizarre). It should be emphasised that because each of these choices is subjective, there are no 'right' or 'wrong' answers. You will notice when you receive the picture pairs that they are letter coded. Please circle below the number of the drawing in each pair which you consider to be the least bizarre.

PAIR A: 1 or 2
PAIR B: 3 or 4
PAIR C: 5 or 6
PAIR D: 7 or 8
PAIR E: 9 or 10

Thanks for all your help - you are appreciated!

(iii) Results

The most important features of the results generated by the present study have been cited directly in the text. Thus, the results pertaining to the first question identified in the present introduction have been presented in Section 5.2.2 (b); the results pertaining to the second question identified have been reported in Section 5.2.4 (a) ii; whilst the results relating to the third question have been variously reported in Sections 5.2.1 (a), 5.2.2 (c) and 5.2.5 (a). Additionally, these results have each been discussed in Section 5.2.5 (a). The only remaining results considered to be of direct interest are given in Table A below; this table indicates the number of different identifications made by the adults of the drawing parts and includes, for comparative purposes, a breakdown of the identifications of these parts made by the preschool children participating in Study Seven.

Table A Identifications of incomplete drawings by 18 adults and 85 preschool children.[1]

CAMEL HEAD			CAMEL BODY			CAT HEAD			CAT BODY			COW HEAD		
Responses	A	C	Responses	A	C	Responses	A	C	Responses	A	C	Responses	A	C
camel	18	56	camel	18	63	cat	18	85	cat	13	15	cow	13	67
don't know		13	don't know		13				don't know		10	bull	5	1
cow		1	dog		1				bear		1	calf		1
dog		1	donkey		1				cow		1	don't know		8
donkey		3	giraffe		2				dog	2	19	bird		1
dinasaur		2	horse		3				dog/cat	1		dog		2
giraffe		2	kangaroo		1				fox		4	elephant		1
horse		3	zebra		1				giraffe		1	horse		3
kangaroo		1							horse		1	seal		1
lamb		1							lion	2	20			
rabbit		1							pig		1			
sheep		1							rabbit		5			
									sheep		2			
									tiger		3			
									wolf		2			

(1) Please note in relation to the tables that first, the responses above the dotted lines were scored as correct and the responses below these lines were scored as erroneous and that second, for each drawing, results column 'A' indicates the adults' responses and results column 'C' indicates the children's responses.

Table A (continued)

COW BODY Responses	A	C	DOG HEAD Responses	A	C	DOG BODY Responses	A	C	ELEPHANT HEAD Responses	A	C	ELEPHANT BODY Responses	A	C
cow	13	47	dog	17	62	dog	16	28	elephant	15	63	elephant	18	62
bull	4	3	wolf		3	wolf		4	Indian elephant	1		don't know		6
cow minus udder	1		sheepdog		2				don't know		11	dog		1
don't know		10	puppy	1		puppy		1	bladder	1		giraffe		1
cat		1	don't know		6	don't know		19	cat		2	horse		1
dog		2	cat		1	cat		3	cow		3	hippo		8
donkey		2	cow		1	cow		2	dog		1	pig		5
elephant		3	deer		1	donkey		6	goose		1	rhino		1
hippo		1	fox		8	fox		4	monkey		1			
horse		14	horsie		1	horse	1	13	mouse		1			
mountain						pig		3						
lion		1	kangaroo		1	sheep	1	2	pipe		1			
pig		1	monkey		1				rock	1				
			sheep		1				swan		3			

Table A (continued)

GIRAFFE HEAD Responses	A	C	GIRAFFE BODY Responses	A	C	HORSE HEAD Responses	A	C	HORSE BODY (STANDING) Responses	A	C	MONKEY HEAD Responses	A	C
giraffe	18	55	giraffe	18	61	horse	11	71	horse	16	65	monkey	13	75
don't know		10	don't know		8	donkey	4	6	donkey	1	5	chimpanzee	4	1
camel		3	camel		2	pony	3	1	pony	1	1	gorilla	1	1
cow		2	cow		1	don't know		2	don't know		3	don't know		5
dog		2	dog		1	calf		1	cow		3	boy		1
donkey		2	horse		9	camel		1	dog		4	cub		1
goat		4	wolf		1	cow		1	elephant		1	donkey		1
horse		3	zebra		2	dog		1	giraffe		1			
kangaroo		1				giraffe		1	monkey		1			
sheep		2							teddy bear		1			
teddy bear		1												

Table A (continued)

MONKEY BODY Responses	A	C	PIG HEAD Responses	A	C	PIG BODY Responses	A	C	SHEEP HEAD Responses	A	C	SHEEP BODY Responses	A	C
monkey	15	54	pig	14	42	pig	18	76	sheep	18	57	sheep	18	64
chimpanzee	2		don't know		11	don't know		1	lamb		13	lamb		14
gorilla		1	cow	1	9	cat		1	don't know		3	don't know		2
don't know		8	dog	3	8	cow		2	camel		4	cow		2
cat		2	fox		6	dog		1	cow		3	dog		1
dog		3	frog		1	elephant		3	dog		1	pig		1
horse		1	horse		4	hippo		1	goat		1	poodle		1
kangaroo	1	2	teddy bear		1				horse		1			
kitten		1	wolf		3				monkey		1			
lion		10							ostrich		1			
tiger		3												

Table A (continued)

DUCK BODY			RABBIT BODY			MAN BODY			GARDEN			HORSE BODY (GALLOPING)		
Responses	A	C	Responses	A	C	Responses	A	C	Responses	A	C	Responses	A	C
duck	17	76	rabbit	9	50	man		62	garden		20	horse	17	–
goose	1	2	don't know		8	person		12	park	13	10	donkey	1	–
bird		2	cat		2	boy		5	trees, pond (ie., description)		34			
don't know		3	chicken		1	farmer		2	beauty spot	1				
chicken		1	cow		1	lady		1	country scene	1				
pigeon		1	fox		1	chair & jumper & trousers & shoes		1	countryside	1	5			
			kangaroo	3	11	don't know		2	farm		6			
			kawala		1				field	1	4			
			lion		1				forest		1			
			squirrel	6	8				house		2			
			quack quack		1				landscape	1				
									railway		2			
									don't know		1			

Appendix H: Details of the preschool subject groups receiving the anomalous stimuli in Study Seven

As indicated in Section 5.2.2 (c) the assignment of subjects was such as to permit nine comparisons to be made statistically. It has also been indicated that each of these comparisons was a straightforward binary comparison and that four of these comparisons concerned whether children are more likely to detect specific monsters when they know the type-identity of both component parts rather than that of only one component part whilst the remaining five comparisons concerned whether children are more likely to detect monsters presumed to be incompatible than monsters presumed to be relatively compatible when they know the type-identity of both component parts, one component part or neither component part respectively. Each of these sets of comparisons is summarised below in Table A.

Table A Summary of the nine comparisons.

(i) Four comparisons concerning the effect of type-knowledge of the component parts.

Comparison No.	Pertinent monsters (constant for each comparison)	Type knowledge bases compared
1.	Horse-Cow	Head only known vs. both parts known.
2.	Giraffe-Camel	Body only known vs. both parts known.
3.	Horse-Monkey	Head only known vs. both parts known.
4.	Dog-Camel	Body only known vs. both parts known.

(ii) Five comparisons concerning the effect of varying compatibility of parts.

Comparison No.	Type knowledge bases (constant for each comparison)	Monsters compared
5.	Both parts known	Horse-Cow vs. Horse-Monkey
6.	Both parts known	Giraffe-Camel vs. Dog-Camel
7.	Head only known	Horse-Cow vs. Horse-Monkey
8.	Body only known	Giraffe-Camel vs. Dog-Camel
9.	Neither part known	Pig-Cow vs. Pig-Monkey

The various characteristics (including the number) of the children who were allocated to each of the comparisons indicated in Table A are given in Table B.

Each of the nine comparisons is given the same number in Tables A and B. It should be observed that whereas the comparisons numbered 1, 2, 3, 4 and 8 were each between two separate groups of subjects, comparison numbers 5 and 6 were each within-subject comparisons whilst comparison numbers 7 and 9 each comprised both a between-and a within-groups comparison. In relation to comparison numbers 7 and 9 respectively, it should be noted that Fisher's method (cf., Kendall and Stuart, 1976) was used to obtain an overall p-value for both the between- and the within-subjects' comparisons.

Table B Characteristics of the subject groups in each of the nine comparisons.

Comparison No.	Kind of Comparison		no.of Ss	mean age	age range	mean screening test score (1)	range of screening test scores	no.of boys (2)
1.	between groups	head only known	10	4:2	3:7–4:7	17	14–20	0
		both parts known	10	4:2	3:3–4:11	17	13–21	4
2.	between groups	body only known	11	4:6	4:2–5:2	19	15–21	5
		both parts known	11	4:6	4:0–5:1	19	14–21	7
3.	between groups	head only known	13	4:4	3:8–5:1	18	8–22	7
		both parts known	13	4:4	3:6–5:2	18	8–22	7
4.	between groups	body only known	12	4:5	4:0–5:1	19	14–22	5
		both parts known	12	4:5	3:9–5:1	19	15–21	5
5.	within groups —	both stimuli	20	4:4	3:4–5:1	20	18–24	10
6.	within groups —	both stimuli	20	4:4	3:3–5:1	19	13–22	9
7.	between groups	horse-cow	8	4:4	4:0–4:7	17	14–20	0
		horse-monkey	8	4:4	3:9–4:11	17	13–21	5
	within groups —	both stimuli	6	4:0	3:7–4:11	13	8–17	2
8.	between groups	giraffe-camel	9	4:7	4:3–5:2	19	15–21	5
		dog-camel	9	4:6	4:1–5:1	19	17–22	5
9.	between groups	pig-cow	10	4:3	3:8–5:0	17	10–20	3
		pig-monkey	10	4:3	3:9–4:11	17	10–20	6
	within groups —	both stimuli	6	3:11	3:7–4:4	12	3–17	2

(1) That is, the mean number of the incomplete drawings for which subjects gave an appropriate type name (cf., Section 5.2.2 (b)).

(2) It is evident that it was not possible to control for the sex composition of the subject groups in each of the between-group comparisons. A balanced sex composition was however actively favoured when this was achievable.

BIBLIOGRAPHY

Anglin, J.M. (1974) Introduction to J.S. Bruner. In J.M. Anglin (ed.) Beyond the Information Given, George Allen and Unwin, London.

Anglin, J.M. (1977) Word, Object and Conceptual Development. Norton, New York.

Arnheim, R. (1969) Visual Thinking. University of California Press, Berkeley and Los Angeles.

Babska, Z. (1965) The formation of the conception of identity of visual characteristics of objects seen successively. In P.E. Mussen (ed.) European research in cognitive development. Monograph of the Society for Research in Child Development 30 : 112-124.

Barrett, M.D. and Light, P.H. (1976) Symbolism and intellectual realism in children's drawings. British Journal of Educational Psychology 46 : 198-202.

Bartlett, F.C. (1916) An experimental study of some problems of perceiving and imaging. British Journal of Psychology 8 : 222-266.

Bartlett, F.C. (1932) Remembering. Cambridge University Press, Cambridge.

Beagles-Roos, J. and Greenfield, P.M. (1979) Development of structure and strategy in two-dimensional pictures. Developmental Psychology 15 : 483-494.

Berlin, B. and Kay, P. (1969) Basic Color Terms: Their Universality and Evolution. University of California Press, Berkeley and Los Angeles.

Berlyne, D.E. (1964) Recent developments in Piaget's work. In R.J.C. Harper, C.C. Anderson, C.M. Christensen and S.M. Hunka (eds) The Cognitive Processes: Readings, Prentice-Hall, Englewood Cliffs, New Jersey, 311-323.

Bettelheim, B. (1976) The Uses of Enchantment: the Meaning and Importance of Fairy Tales. Thames and Hudson, London.

Beveridge, M. and Dunn, J. (1980) Communication and the Development of Reflective Thinking. Paper presented at the Annual Conference of the Developmental Section of the British Psychological Society, University of Edinburgh, 5th September, 1980.

Bierwisch, M. (1969) On certain problems of semantic representation. Foundations of Language 5 : 153-184.

Bowerman, M. (1977) The acquisition of word meaning: an investigation of some current conflicts. In P.N. Johnson-Laird and P.C. Wason (eds) Thinking: Readings in Cognitive Science, Cambridge University Press, Cambridge, 239-256.

Brainerd, C.J. (1978) Piaget's Theory of Intelligence. Prentice-Hall, Englewood Cliffs, New Jersey.

Bransford, J.D. (1970) The Problems of Conceptual Abstraction: Implications for Theories of Learning and Memory. Unpublished manuscript, University of Minnesota. As cited by J.M. Anglin (1977) - cf., above.

Brian, C.R. and Goodenough, F.L. (1929) The relative potency of color and form perception at various ages. Journal of Experimental Psychology 12 : 197-213.

Brown, R. (1956) Language and categories. In J. Bruner, J.J. Goodnow and G.A. Austin (eds) A Study of Thinking, Wiley, New York, 247-312.

Brown, R. (1958 a) How shall a thing be called? Psychological Review 65: 14-21.

Brown, R. (1958 b) Words and Things. The Free Press, New York.

Brown, R. (1976) Reference: In memorial tribute to Eric Lenneberg. Cognition 4 : 125-153.

Bruner, J.S. (1957) On perceptual readiness. Psychological Review 64 : 123-152.

Bruner, J.S. (1974) Beyond the Information Given: Studies in the Psychology of Knowing. Book of Readings ed. by J.M. Anglin, George Allen and Unwin, London.

Bruner, J.S., Goodnow J.J. and Austin, G.A. (1956) A Study of Thinking. Wiley, New York.

Bruner, J.S. and Olver, R.R. (1963) Development of equivalence transformations in children. In J.C. Wright and J. Kagan (eds) Basic cognitive processes in children. Monograph of the Society for Research in Child Development 28 : 125-143.

Bruner, J.S., Olver, R.R., Greenfield, P.M. et al. (1966) Studies in Cognitive Growth. Wiley, New York.

Burgemeister, B.B., Blum, L.H. and Lorge, I. (1954) Columbia Mental Maturity Scale, first edition. World Book Company, Yonkers-on-Hudson, New York.

Butterworth, G. (1978) Thought and things: Piaget's theory. In A. Burton and J. Radford (eds) Thinking in Perspective: Critical Issues in the Study of Thought Processes, Methuen, London, 65-89.

Caldwell, E.C. and Hall, V.C. (1970) Distinctive-features versus prototype learning reexamined. Journal of Experimental Psychology 11 : 7-12.

Cameron, N. (1938) Functional immaturity in the symbolizations of scientifically trained adults. Journal of Psychology 6 : 161-175.

Campbell, R., Donaldson, M. and Young, B. (1976) Constraints on classificatory skills in young children.British Journal of Psychology 67 : 89-100.

Carmichael, L., Hogan, H.P. and Walters, A.A. (1932) An experimental study of the effect of language on visually perceived form. Journal of Experimental Psychology 15 : 73-86.

Cassirer, E. (1946) Language and Myth. Dover Publications, New York.

Cassirer, E. (1953) Structure and Function and Einstein's Theory of Relativity. Dover Publications, New York.

Chalmers, M. and McGonigle, B.O. (1979) Contextual and task effects on children's information processing. Neuroscience Letters Supplement 3, 58.

Clark, E. (1973) What's in a word? On the child's acquisition of semantics in his first language. In T.E. Moore (ed.) Cognitive Development and the Acquisition of Language, Academic Press, London, 65-110.

Clark, E. (1974) Some aspects of the conceptual basis for first language acquisition. In R.L. Schiefelbusch and L.L. Lloyd (eds) Language Perspectives - Acquisition, Retardation and Intervention. University Park Press, Baltimore, Maryland, 105-128.

Clark, E. (1975) Knowledge, context and strategy in the acquisition of meaning. In D. Dato (ed.) Developmental Psycholinguistics: Theory and Applications (26th Annual Georgetown University Roundtable), Georgetown University Press, Washington, D.C., 77-98.

Clark, H.H. and Clark, E.V. (1977) Psychology and Language: An Introduction to Psycholinguistics. Harcourt Brace Jovanovich, New York.

Clay, M.M. (1979) The Early Detection of Reading Difficulties: A Diagnostic Survey with Recovery Procedures, second edition. Heinemann Educational Books, Auckland.

Colby, M. and Robertson, G. (1942) Genetic studies in abstraction. Journal of Comparative and Physiological Psychology 33 : 385-401.

Corah, N.L. (1964) Color and form in children's perceptual behavior. Perceptual and Motor Skills 18 : 313-316.

Corah, N.L. (1966) The influence of some stimulus characteristics on color and form perception in nursery-school children. Child Development 37 : 205-211.

Corah, N.L. and Gospodinoff, E.J. (1966) Color - form and whole-part perception in children. Child Development 37 : 837-842.

Corah, N.L. and Gross, J.B. (1967) Hue, brightness and saturation variables in color - form matching. Child Development 38 : 137-142.

Corah, N.L., Jones, S.A. and Miller, B.B. (1966) The relation of verbal intelligence and color - form discriminative ability to children's behavior. Journal of Psychology 62 : 221-228.

Cramaussel, E. (1924) Ce 'que voient des yeux d'enfant. Journal de Psychologie Normale et Pathologique 21 : 161-169.

Deregowski, J.B. (1977) Pictures, symbols and frames of reference. In G. Butterworth (ed.) The Child's Representation of the World, Plenum Press, New York and London, 219-236.

Deregowski, J.B. (1980) Illusions, Patterns and Pictures: A Cross-Cultural Perspective. Academic Press, London.

Descoeudres, A. (1914) Coleur, forme ou nombre. Archives de Psychologie 14 : 305-341.

Dewey, J. (1891) Psychology. American Book Company, New York.

Donaldson, M. (1976) Development of conceptualization. In V. Hamilton and M.D. Vernon (eds) The Development of Cognitive Processes, Academic Press, London, 277-303.

Donaldson, M. (1978) Children's Minds. Fontana/Collins, Glasgow.

Donaldson, M. (1981) Personal Communication, University of Edinburgh, Edinburgh.

Donaldson, M. (1983) Personal Communication, University of Edinburgh, Edinburgh.

Donaldson, M. (In Press) On speech and writing and modes of learning. In Awakening to Literacy: University of Victoria Symposium. Heinemann Educational Books.

Eljasch, M. (1928) Neue abstraktionsversuche bei vorschulpflichtigen kindern. Zeitschrift für Psychologie 105 : 1-42.

Elkind, D. (1964) Ambiguous pictures for study of perceptual development and learning. Child Development 35 : 1391-1396.

Elkind, D. (1969) Developmental studies of figurative perception. In L. Lipsitt and H.W. Reese (eds) Advances in Child Development and Behavior, volume 4, Academic Press, New York, 1-28.

Elkind, D. (1975) Perceptual development in children. American Scientist 63 : 533-541.

Elkind, D., Koegler, R.R. and Go, E. (1962) Effects of perceptual training at three age levels. Science 137 : 3532.

Elkind, D., Koegler, R.R. and Go, E. (1964) Studies in perceptual development: II, Part-whole perception. Child Development 35 : 81-90.

Elkind, D. and Scott, L. (1962) Studies in perceptual development: I, the decentering of perception. Child Development 33 : 619-630.

Evans, S.H. (1967) Redundancy as a variable in pattern perception. Psychological Bulletin 67 : 104-113.

Farnham-Diggory, S. (1976) Development of logical operations and reasoning. In V. Hamilton and M.D. Vernon (eds) The Development of Cognitive Processes, Academic Press, London, 359-412.

Ferreiro, E. (1978) What is written in a written sentence? A developmental answer. Journal of Education 160 : 25-39.

Fisher, G.H. (1968) Ambiguity of form: old and new. Perception and Psychophysics 4 : 189-192.

Flavell, J.H. (1963) The Developmental Psychology of Jean Piaget. Van Nostrand, Princeton, New Jersey.

Flavell, J.H. (1977) Cognitive Development. Prentice-Hall, Englewood Cliffs, New Jersey.

Fodor, J. (1972) Some reflections on L.S. Vygotsky's Thought and Language. Cognition 1 : 83-95.

Fodor, J. (1976) The Language of Thought. Harvester Press, Hassocks, Sussex.

Ford, W. and Olson, D. (1975) The elaboration of the noun phrase in children's description of objects. Journal of Experimental Child Psychology 19 : 371-382.

Forman, G.E., Kuschner, D.S. and Dempsey, J. (1975) Visual decentration: from stereometric points to planeometric forms. Perceptual and Motor Skills 41 : 343-352.

Freedle, R.O. (1972) Language users as fallible information processors: implications for measuring and modelling comprehension. In R.O. Freedle and J.B. Carroll (eds) Language Comprehension and the Acquisition of Knowledge, V.H. Winston and Sons, New York. As cited by W. Ford and D. Olson (1975) - cf., above.

Freeman, N.H. (1977) How young children try to plan drawings. In G. Butterworth (ed.) The Child's Representation of the World, Plenum Press, New York and London, 3-29.

Freeman, N.H. (1980) Strategies of Representation in Young Children. Academic Press, London and New York.

Garner, W.R. (1962) Uncertainty and Structure as Psychological Concepts. Wiley, New York.

Garner, W.R. (1970) The stimulus in information processing. American Psychologist 25 : 350-358.

Garner, W.R. (1974) The Processing of Information and Structure. Lawrence Erlbaum Associates, Potomac, Maryland.

Garner, W.R. (1978) Aspects of a stimulus. In E. Rosch and B.B. Lloyd (eds) Cognition and Categorization, Lawrence Erlbaum Associates, Hillsdale, New Jersey, 99-133.

Gibson, J.J. (1929) The reproduction of visually perceived forms. Journal of Experimental Psychology 12 : 1-39.

Gibson, J.J. (1954) A theory of pictorial perception. Audio-Visual Communication Review 1 : 3-23.

Glass, A.L. and Holyoak, K.J. (1975) Alternative conceptions of semantic memory. Cognition 3 : 313-339.

Goldberg, S., Perlmutter, M. and Myers, N. (1974) Recall of related and unrelated lists of 2-year-olds. Journal of Experimental Child Psychology 18 : 1-8.

Gollin, E.S. (1960) Developmental studies of visual recognition of incomplete objects. Perceptual and Motor Skills 11 : 289-298.

Gollin, E.S. (1961) Further studies of visual recognition of incomplete objects. Perceptual and Motor Skills 13 : 307-314.

Gollin, E.S. (1962) Factors affecting the visual recognition of incomplete objects: a comparative investigation of children and adults. Perceptual and Motor Skills 15 : 583-590.

Gollin, E.S. (1965) Perceptual learning of incomplete pictures. Perceptual and Motor Skills 21 : 439-445.

Gollin, E.S. (1966) Serial learning and perceptual recognition in children: training, delay and order effects. Perceptual and Motor Skills 23 : 751-758.

Goodnow, J. (1977) Children's Drawing. Fontanna, London.

Greenfield, P.M. and Bruner, J.S. (1974) Culture and cognitive growth. In J.M. Anglin (ed.) Beyond the Information Given: Studies in the Psychology of Knowing, George Allen and Unwin, London, 368-393.

Hampton, J.A. (1979) Polymorphous concepts in semantic memory. Journal of Verbal Learning and Verbal Behavior 18 : 441-461.

Hayes, K. and Hayes, C. (1953) Picture perception in a home-raised chimp.Journal of Comparative and Physiological Psychology 46 : 470-474.

Herrnstein, R.J. and Loveland, D.H. (1964) Complex visual concept in pigeon. Science. 146 : 549-551.

Herrnstein, R.J., Loveland, D. and Cable, C. (1976) Natural concepts in pigeons. Journal of Experimental Psychology: Animal Behavior Processes 2 : 285-302.

Hochberg, J. and Brooks, V. (1962) Pictorial recognition as an unlearned ability: a study of one child's performance. American Journal of Psychology 75 : 624-628.

Hollobow, N. (1981) Linguistic Awareness and Development in Young Children. Unpublished manuscript, University of Edinburgh.

Huang, I. (1945) Abstraction of form and color in children as a function of the stimulus objects. The Journal of Genetic Psychology 66 : 59-62.

Ianco-Worrall, A.D. (1972) Bilingualism and cognitive development. Child Development 43 : 1390-1400.

Inhelder, B and Piaget, J. (1964) The Early Growth of Logic in the Child: Classification and Seriation. Routledge and Kegan Paul, London.

James, W. (1890) Principles of Psychology, volume 1. Holt, New York.

Johnson-Laird, P.N. and Wason, P.C. (1977) Introduction to conceptual thinking. In P.N. Johnson-Laird and P.C. Wason (eds) Thinking: Readings in Cognitive Science, Cambridge University Press, Cambridge, 169-184.

Jones, R.K. and Hagen, M. (1980) A perspective on cross-cultural picture perception. In M.A. Hagen (ed.) The Perception of Pictures, volume 2, Academic Press, New York, 193-226.

Kagan, J. and Lemkin, J. (1961) Form, color and size in children's conceptual behavior. Child Development 32 : 25-28.

Katz, D. (1913) Studien zur kinderpsychologie. Wiss. Beitr. Padag. und Psychol., 4 Leipzig. Cited by (for example) B.J. Lindberg (1938) Experimental studies of colour and non-colour attitude in schoolchildren and adults. Acta Psychiatrica et Neurologica, Supplement 16, Ejnar Munksgaard, Copenhagen.

Katz, J.J. and Fodor, J.A. (1963) The structure of a semantic theory. Language 39 : 170-210.

Kaufmann, G. (1980) Visual Imagery and its relation to problem solving. Universitetsforlaget, Oslo.

Kendall, M.G. and Stuart, A. (1976) The Advanced Theory of Statistics, third edition. Griffins, London.

Kendler, T.S. (1961) Concept formation. Annual Review of Psychology 12 : 447-472.

Kennedy, J.M. (1974) A Psychology of Picture Perception. Jossey-Bass, San Francisco.

Klank, L.J.K., Huang, Y.H. and Johnson, R.C. (1971) Determinants of success in matching word pairs in tests of phonetic symbolism. Journal of Verbal Learning and Verbal Behavior 10 : 140-148.

Köhler, W. (1925) The Mentality of Apes. Harcourt, New York.

Kosslyn, S.M. (1978) The Representational-Development Hypothesis. In P.A. Ornstein (ed.) Memory Development in Children, Lawrence Erlbaum Associates, Hillsdale, New Jersey, 157-189.

Kuenburg, G.M., von (1920) Über abstraktionsfähigkeit und die entstehung von relationen beim vorschulpflichtigen kinde. Zeitschrift für angewandte Psychologie 17 : 270-312.

Labov, W. (1973) The boundaries of words and their meanings. In C.J.N. Bailey and R.W. Shuy (eds) New Ways of Analyzing Variation in English, Georgetown University Press, Washington, D.C., 340-373.

Lenneberg, E.H. (1957) A probablistic approach to language learning. Behavioral Science 2 : 1-12.

Lenneberg, E.H. (1967) Biological Foundations of Language, Wiley, New York.

Ling, B.C. (1941) Form discrimination as a learning cue in infants. Comparative Psychology Monographs 17 : 66.

Lloyd, P. (1975) Communication in Pre-School Children. Unpublished doctoral dissertation, University of Edinburgh.

Luchins, A.S. (1945) Social influences on perception of complex drawings. Journal of Social Psychology 21 : 257-273.

Luquet, G.H. (1913) Les Dessins d'un Enfant, Alcan, Paris.

Luquet, G.J. (1927) Le Dessin Enfantin. Alcan, Paris.

Luria, A.R. (1961) The Role of Speech in the Regulation of Normal and Abnormal Behaviour. Pergamon Press, New York.

Macdonald, C. (1982) Personal Communication, University of Edinburgh, Edinburgh.

Macnamara, J. (1972) Cognitive basis of language learning in infants. Psychological Review 79 : 1-13.

McCloskey, M.E. and Glucksberg, S. (1978) Natural categories: well defined or fuzzy sets? Memory and Cognition 6 : 462-472.

McGarrigle, J., Grieve, R. and Hughes, M. (1978) Interpreting Inclusion: A contribution to the study of the child's cognitive and linguistic development. Journal of Experimental Child Psychology 26 : 528-550.

Medin, D.L. and Schaffer, M.M. (1978) A context theory of classification learning. Psychological Review 85 : 207-238.

Meili, R. (1931) Les perceptions des enfants et la psychologie de la Gestalt. Archives de Psychologie 23 : 25-44.

Meili-Dworetski, G. (1956) The development of perception in the Rorschach. In B. Klopfer (ed.) Developments in the Rorschach technique, volume 2, World Book, Yonkers, New York.

Mervis, C.D. and Rosch, E. (1981) Categorisation of natural objects. Annual Review of Psychology 32 : 89-115.

Miller, G.A. and Johnson-Laird, P.N. (1976) Language and Perception. Cambridge University Press, Cambridge.

Neisser, U. (1967) Cognitive Psychology. Appleton-Century Crofts, New York.

Nelson, K. (1973) Some evidence for the cognitive primacy of categorization and its functional basis. Merrill-Palmer Quarterly of Behavior and Development 19 : 21-39.

Nelson, K. (1974) Concept, word and sentence: interrelations in acquisition and development. Psychological Review. 81 : 267-285.

Nelson, K. (1977) The conceptual basis for naming. In J. Macnamara (ed.) Language Learning and Thought, Academic Press, New York, 117-136.

Nelson, K. and Gruendel, J. (1981) Generalized event representations: basic building blocks of cognitive development. In M.E. Lamb and A.L. Brown (eds) Advances in Developmental Psychology, volume 1 Lawrence Erlbaum Associates, London, 131-158.

Nelson, K.,Rescorla, L., Gruendel, J. and Benedict, H. (1978) Early lexicons: what do they mean? Child Development 49 : 960-968.

Oléron, P. (1962) Le développement des réponses a la relation identité-dissemblance. Ses rapports avec le langage. Psychologie Francaise 7 : 4-16.

Olson, D.R. (1970) Language and thought: aspects of a cognitive theory of semantics. Psychological Review 77 : 257-273.

Olson, R., Yonas, A. and Cooper, R. (1980) Development of pictorial perception. In M.A. Hagen (ed.) The Perception of Pictures, volume 2, Academic Press, New York, 155-192.

Osherson, D. and Markman, E. (1975) Language and the ability to evaluate contradictions and tautologies. Cognition 3 : 213-226.

Piaget, J. (1928) Judgment and Reasoning in the Child. Routledge and Kegan Paul, London.

Piaget, J. (1929) The Child's Conception of the World. Routledge and Kegan Paul, London.

Piaget, J. (1950) The Psychology of Intelligence. Routledge and Kegan Paul, London.

Piaget, J. (1951) Play, Dreams and Imitation in Childhood. Routledge and Kegan Paul, London.

Piaget, J. (1968 a) On the Development of Memory and Identity. Clark University Press with Barre Publishers, Barre, Massachusetts.

Piaget, J. (1968 b) Language and thought from the genetic point of view. In J. Piaget Six Psychological Studies, University of London Press, London.

Piaget, J. (1969) The Mechanisms of Perception. Routledge and Kegan Paul, London.

Piaget, J. and Inhelder, B. (1956) The Child's Conception of Space. Routledge and Kegan Paul, London.

Piaget, J. and Inhelder, B. (1969) The Psychology of the Child. Routledge and Kegan Paul, London.

Pikas, A. (1966) Abstraction and Concept Formation. Harvard University Press, Cambridge, Massachusetts.

Potter, M.C. (1966) On perceptual recognition. In J.S. Bruner, R.R. Olver, P.M. Greenfield et al. Studies in Cognitive Growth, Wiley, New York, 103-134.

Reichard, S., Schneider, M. and Rapaport, D. (1944) The development of concept formation in children. American Journal of Orthopsychiatry 14 : 156-161.

Reid, J.F. (1966) Learning to think about reading. Educational Research 9 : 56-62.

Reid, J.F. and Low, J. (1972) Link-up. Holmes McDougall, Edinburgh.

Rey, A. (1947) Étude des Insuffisances Psychologiques. I. Méthodes et Problèmes. Delachaux & Niestlé, Neuchâtel, Paris, (second edition, 1962).

Ricciuti, H.N. (1965) Object grouping and selective ordering behavior in infants 12-24 months old. Merill-Palmer Quarterly of Behavior and Development 11 : 129-148.

Rips, L.J., Shoben, E.J. and Smith, E.E. (1973) Semantic distance and the verification of semantic relations. Journal of Verbal Learning and Verbal Behavior 12 : 1-20.

Rosch, E. (1977) Classification of real-world objects: origins and representations in cognition. In P.N. Johnson-Laird and P.C. Wason (eds) Thinking: Readings in Cognitive Science, Cambridge University Press, Cambridge, 212-222.

Rosch, E. (1978) Principles of categorization. In E. Rosch and B.B. Lloyd (eds) Cognition and Categorization, Lawrence Erlbaum Associates, Hillsdale, New Jersey, 27-48.

Rosch, E. and Mervis, C.B. (1975) Family resemblances: studies in the internal structure of categories. Cognitive Psychology 7 : 573-605.

Rosch, E., Mervis, C.B., Gray, W.D., Johnson, D.M. and Boyes-Braem, P. (1976) Basic objects in natural categories. Cognitive Psychology 8 : 382-439.

Segers, J.E. (1926 a) Recherches sur la perception visuelle chez des enfants âgés de 3 à 13 ans et leur application à l'éducation. Journal de Psychologie Normale et Pathologique 23 : 723-753.

Segers, J.E. (1926 b) Recherches sur la perception visuelle chez des enfants âgés de 3 à 13 ans et leur application à l'éducation. Journal de Psychologie Normale et Pathologique 23 : 608-636.

Serpell, R. (1966) Selective attention in matching from sample by children. Human Development Research Unit Reports 2, University of Zambia, mimeo. As cited by R. Serpell (1969) - cf., below.

Serpell, R. (1969) The influence of language, education and culture on attentional preference between colour and form. International Journal of Psychology 4 : 183-194.

Shepp, B.E. (1978) From perceived similarity to dimensional structure: a new hypothesis about perceptual development. In E. Rosch and B.B. Lloyd (eds) Cognition and Categorization, Lawrence Erlbaum Associates, Hillsdale, New Jersey, 135-165.

Shepp, B.E., Burns, B. and McDonough, D. (1980) The relation of stimulus structure to perceptual and cognitive development: further tests of a separability hypothesis. In F. Wilkening, J. Becker and T. Trabasso (eds) Information Integration by Children, Lawrence Erlbaum Associates, Hillsdale, New Jersey, 113-145.

Siegel, S. (1956) Nonparametric Statistics for the Behavioral Sciences. McGraw-Hill Kogakusha, Tokyo.

Smith, E.E. and Medin, D.L. (1981) Categories and Concepts. Harvard University Press, Cambridge, Massachusetts.

Smith, E.E., Shoben, E.J. and Ripps, L.J. (1974) Structure and process in semantic memory: a featural model for semantic decisions. Psychological Review 81 : 214-241.

Suchmann, R.G. and Trabasso, T. (1966) Color and form preference in young children. Journal of Experimental Child Psychology 3 : 177-187.

Sully, J. (1896) Studies of Childhood. Longmans Green, London.

Tobie, H. (1926) Die entwicklung der teilinhaltlichen beachtung von farbe und form im vorschulpflichtigen kindesalter. Beihefte zur Zeitschrift für angewandte Psychologie 38 : 1-103.

Vernon, M.D. (1954) A Further Study of Visual Perception. Cambridge University Press, Cambridge.

Vernon, M.D. (1971) The Psychology of Perception, second edition, Penguin, Harmondsworth, Middlesex.

Volkelt, H. (1926) Fortschritte der experimentellen kinderpsychologie. Bericht über den 9. Kongrefs für Experimentelle Psychologie in München, 1925. Jena 1926, S.81. As cited (for example) by Eljasch (1928) - cf., above.

Vurpillot, E. (1962) Détails caractéristiques et reconnaissance de formes familières. Psychologie Francaise 7 : 147-155.

Vurpillot, E. (1968) The development of scanning strategies and their relation to visual differentiation. Journal of Experimental Child Psychology 6 : 632-650.

Vurpillot, E. (1976 a) The Visual World of the Child. George Allen and Unwin, London.

Vurpillot, E. (1976 b) Development of identification of objects. In V. Hamilton and M.D. Vernon (eds) The Development of Cognitive Processes. Academic Press, London, 191-236.

Vurpillot, E. and Moal, A. (1970) Évolution des critères d'identité chez des enfants d'âge préscolaire dans une tâche de différenciation perceptive. Année Psychologique 70 : 391-406.

Vygotsky, L.S. (1962) Thought and Language. M.I.T. Press,Massachusetts Institute of Technology, Cambridge, Massachusetts.

Welch, L. (1940) A preliminary investigation of some aspects of the hierarchical development of concepts. Journal of General Psychology 22 : 359-378.

Welch, L. (1947) A behaviorist explanation of concept formation. Journal of Genetic Psychology 71 : 201-222.

Werner, H. (1948) Comparative Psychology of Mental Development. Follett, New York.

Wheeler, R. (1972) Children's Understanding of Pictures as Representations of Objects. Unpublished Honours Thesis, University of Edinburgh.

Whiteside, J.A., Elkind, D. and Golbeck, S.L. (1976) Effects of exposure duration on part-whole perception in children. Child Development 47 : 498-501.

Whitfield, T.W.A. and Slatter, P.E. (1979) The effects of categorization and prototypicality on aesthetic choice in a furniture selection task. British Journal of Psychology 70 : 65-75.

Wilkening, F., Becker, J. and Trabasso, T. (1980) Preface. In F. Wilkening, J. Becker and T. Trabasso (eds) Information Integration by Children, Lawrence Erlbaum Associates, Hillsdale, New Jersey,

Williams, T.M., Fryer, M.L. and Aiken, L.S. (1977) Development of visual pattern classification in preschool children: prototypes and distinctive features. Developmental Psychology 13 : 577-584.

Wittgenstein, L. (1958) Philosophical Investigations, second edition. Blackwell, Oxford.

Wohlwill, J. (1968) From perception to inference: a dimension of cognitive development. In I.E. Sigel and F.H. Hooper (eds) Logical Thinking in Children, Holt, Rinehart and Winston, New York, 472-494.

Zaporozhets, A.V. and Zinchenko, V.P. (1966) Development of perceptual activity and formation of a sensory image in the child. In Psychological Research in the U.S.S.R., Progress Publishers, Moscow. As cited by Vurpillot (1976 b) - cf., above.